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BLACKISH CRANE-HAWK

(Geranospiza nigra)

Adult female. Painted in the field from a specimen collected February 20, 1938, along the Río Corona, near the village of Güemes, Tamaulipas, México, by George Miksch Sutton. This is the eighth of a series of color plates honoring the memory of Dr. David Clark Hilton.

BLACKISH CRANE-HAWK

BY GEORGE MIKSCH SUTTON

THE hawks of the New World genus *Geranospiza* are among the most remarkable of extant falconiform birds. They are light-weight, middle-sized hawks with small head, rather small bill, long, slender legs, fluffy plumage, rounded wings, and long, broad tail. Their leg feathering is without "flags." Their toes are short—especially the outer. The scales of the tarsi are so fused as to present an almost smooth surface in front and on the outer side. The legs are "double-jointed." In reaching down through roots or brush or into holes after prey, *Geranospiza* may flex its tibiotarsal joints either forward or backward. This adaptive character it has in common with *Gymnogenys* of Africa and Madagascar (Friedmann, 1950. *U.S. Natl. Mus. Bull.* 50, part 11, p. 516).

The only species of the genus *Geranospiza* known to me from personal field-experience is the Blackish Crane-Hawk (*G. nigra*), a bird currently believed to breed from central Tamaulipas and extreme southern Sonora southward through Middle America and South America west of the Andes to southwestern Ecuador and Puna Island (Peters, 1931. "Check-List of Birds of the World," 1:268). Presumably the species is non-migratory throughout its range.

The Blackish Crane-Hawk is about 18–20 inches long, the female being considerably larger than the male. In unworn adult plumage it is slaty black with a bluish or purplish bloom. The base of the tail is white, the very tip is grayish white, and there are two broad white bars additionally, the more distal being somewhat the less distinct because, especially on the outer webs of the feathers, the white is washed with gray. Narrow white tipping of the plumage of the under parts produces a thin barring especially noticeable on the tibial part of the legs. The nape plumage is white basally. In some specimens the chin, throat, and loral feathers are more or less white. The under-wing varies: in some individuals the remiges and coverts are spotted and barred with white; in others the white is reduced to a series of squarish spots, one on the inner web of each of the four or five outer primaries. The eyes are bright red; the cere, eyelids, and mouth-corners dull gray; the bill black with bluish cast; the tarsi and toes orange or red-orange; the claws black.

In immature birds the forehead, superciliary area, auriculars, chin, upper throat, and under parts in general are more or less streaked with buffy white; the plumage otherwise is brownish black. Dickey and van Rossem (1938. *Field Mus. Nat. Hist. Zool. Ser.* 23:130) state that the "juvenal plumage" is worn "until the second fall," and describe the eye-color of a several-months-

old bird taken in El Salvador in February as reddish brown; of a "fully grown juvenile (recently from nest) in August" as orange.

My friend William J. Sheffler, of Los Angeles, has been good enough to put at my disposal a summary of his really considerable experience with this all but unknown hawk in southern Sonora. In the Sheffler Collection is a nestling female (WJS 2937) taken at a "presumed age of five weeks" and still unable to fly, at 2100 feet elevation in the Tarahumar Mountains, near Guirocoba, on June 4, 1950. Mr. Sheffler describes this specimen thus: "Forehead, supercilium, chin and throat white; crown and nape black, the white basal part of the feathers showing conspicuously; cheeks and ear coverts light gray. Upper part of body black, the wings with white markings much as in the adult. Upper tail coverts black, each with a white bar; rectrices black with white tip and a broad bar near the middle, this bar being grayish white in the middle pair and in the five other pairs buff on the inner web to gray on the outer web. The primaries, secondaries and rectrices are only about half grown. The under parts are mottled with black and cinnamon buff (Tawny Olive of Ridgway), the vent and under tail coverts being pure Tawny Olive. In the living bird the eyes were yellowish red, the bill black, the legs and feet yellowish orange, much lighter than in the adult." This last statement is entirely valid, for Sheffler collected the male parent also and was able to compare the two specimens directly.

The Blackish Crane-Hawk inhabits tropical lowlands. Sturgis (1928. "Field Book of Birds of the Panama Canal Zone," p. 131) says that it lives "near marshes and ponds in heavy forest." Dickey and van Rossem (*op. cit.*, p. 129), describe it as "primarily a bird of swamp forest and mangrove lagoons . . . seldom found away from the immediate vicinity of water" in El Salvador. M. A. del Toro (1952. "Los Animales Silvestres de Chiapas," p. 121) says that it inhabits the banks of rivers and lakes. Carriker (1910. *Ann. Carnegie Mus.*, 6:454) says that in Costa Rica it "is always found in the vicinity of water, usually a sluggish lagoon or pond." J. C. Phillips (1911. *Auk*, 28:73) has reported it from Cañon Guiaves, in the hill district near Victoria, Tamaulipas. The elevation of this locality is not known to me, but I believe it to be considerably greater than that of the Corona and Sabinas, Tamaulipan rivers along which Thomas D. Burleigh, John B. Semple and I found the species in the early spring of 1938 (Sutton and Burleigh, 1939. *Occ. Pap. Mus. Zool. Louisiana State Univ.*, 3:27). Sumichrast (1876. *U.S. Natl. Mus. Bull.* 4:40), who reports *G. nigra* from "both sides of Mexico," has this to say of its habitat and behavior: "It never leaves the woods, where, gliding with rapidity among the thickets of vines, it gives chase to the small lizards, tree-frogs, insects, etc."

In southern Sonora the species may prefer to live near streams, but its

habitat there has very little water during much of the year. No mere accident is van Rossem's (1945. *Occ. Pap. Mus. Zool. Louisiana State Univ.*, 21:60) choice of words when, in discussing habitat, he writes of "Tropical zone riparian associations" rather than of lowland woods near water. Mr. Sheffler's comments on the bird's altitudinal distribution and ecology in southern Sonora merit close study. These read: "I have never seen this bird at much greater elevation than 2000 feet. On the other hand, I have never encountered it below 1500 feet, although I have in my collection an immature male taken by van Rossem at Tesia, in the lower Mayo River valley, June 19, 1937. Tesia is 16 miles east of Navojoa, and its elevation is about 200 feet.

"I have observed this bird hunting over the land like a Marsh Hawk (*Circus cyaneus*) only in the winter months. In the spring and summer I have seen it hunting quietly in the shelter of large trees along streams and cienagas. There is little water about Guirocoba, the area being for the most part arid tropical. Elevation at the Guirocoba ranch-house, from which point I have several times observed the bird, is 1540 feet."

Dickey and van Rossem (*op. cit.*, pp. 129–130) consider the Blackish Crane-Hawk "a more active bird" than either the Urubitinga (*Hypomorphnus urubitinga*) or the Mexican Black Hawk (*Buteogallus anthracinus*), "with both of which it may frequently be found . . ." Discussing its behavior, they say that it quarters a meadow in the manner of a Marsh Hawk. "A burning pasture is a sure attraction, and it often hunts through the smoke right behind the fire line."

Mr. Sheffler had an interesting experience with a Blackish Crane-Hawk near the Guirocoba ranch-house on November 17, 1944. That day, from the south front of the house, he saw a crane-hawk about a quarter of a mile away beating back and forth not far above ground, looking for prey. The principal vegetation of the hunting-ground was small, thorny, tropical plants, but there was a scattering of large mesquite-like trees, several large pitahaya cactus plants, and some grass. Some years previously the area had been planted to cotton, peanuts, and grain, but it had returned to a wild state. Here and there were rock mounds, the rocks ranging from the size of a man's head to three or four times that large, the mounds being about three feet high at the peak. Mr. Sheffler continues: "While I was attempting to stalk the bird, it lit on the side of one of these rock mounds, much out of gun-range. As I watched it through my glasses it jumped about the mound in the manner of some sort of mammal. Reaching its foot into the crevices, it finally came out with what appeared to be a large lizard. I could not stalk the bird from my position for there was no cover, but I continued to watch it. A minute or so after it had pulled its prey from the rocks, Dr. Ralph A. Woods, who had approached from the opposite side, shot the hawk from the concealment of a

small wash. We found that it had caught an iguana about eleven inches long. Instead of attempting to swallow this prey, it had promptly cut through the back, just behind the front legs, to get at the soft parts. In the hawk's stomach we found parts of at least two more lizards."

An adult female specimen collected by Thomas D. Burleigh along the Río Corona, near the village of Güemes, Tamaulipas, on February 20, 1938, had eaten "a small green lizard" (Sutton, 1951. "Mexican Birds," p. 131). This crane-hawk specimen served as the model for our colored frontispiece.

Wetmore (1943. *Proc. U.S. Natl. Mus.*, 93:241) gives us this account of his meeting with this species in southern Veracruz: "On April 4, 1939, I shot a male at the Arroyo Corredor. As I moved quietly among the trees I suddenly saw its dark form clearly through the branches as it perched 15 feet from the ground in heavy, open forest. It was eating a large orthopteran."

Mr. Sheffler examined the stomach- and crop-contents of four of the five Blackish Crane-Hawk specimens (three adult, two immature) now in his collection. The stomach of an adult (WJS 2261, sex?) taken by Sheffler himself at Guirocoba ranch on May 21, 1945, contained "parts of a small snake and remains of lizards." The crop of an adult male (WJS 2934) taken by Sheffler at a nest in the Tarahumar Mountains, near Guirocoba, was "very full of lizards and parts of small snakes." This male was the parent of the well-feathered nestling described in detail above. The stomach of the nestling was empty, so the old bird must have been about to feed its progeny.

Lovie M. Whitaker, of Norman, Oklahoma, and Edna W. Miner, of Houston, Texas, observed the feeding behavior of a Blackish Crane-Hawk along the Río Corona, in Tamaulipas, not far from the spot at which T. D. Burleigh took the specimen above referred to. Camped near the place at which the Brownsville-to-Victoria highway crosses the river, the two women were looking for birds. The date was August 15, 1949. A black hawk, perched on a horizontal branch only eight or ten feet from the ground near the trunk of a giant cypress (*Taxodium distichum*) on the north side of the river, directly opposite from them and about 30 yards away, they identified as an adult *G. nigra*. The bird seemed little concerned over their presence, and they watched it for fully twenty minutes. Mrs. Whitaker has furnished me with a full account of the experience, from which I quote:

"The hawk's lax, slaty black plumage had a pronounced bloom about the foreparts. We noticed the Chinese red of the eyes; the bright orange-yellow of the long tarsi and toes; the small gray bill and gray cere; the two white bars in the long, white-tipped tail; and the lacy white tipping of the leg feathers, breast feathers, and under tail coverts. When we "squeaked," the bird turned its head and stared at us intently, but its apathetic demeanor did not change. At times it lifted the feathers of its crown and nape into a loose,

thin crest. Then it depressed the median crown plumage, leaving certain feathers at either side standing as a short, slightly recurved tuft above the back of each eye. This gave it a somewhat 'horned' appearance.

"Wishing to see the manner of flight this apparently sluggish bird might have, we 'shooed' it—but it would not fly.

"When it flew of its own volition we were astonished. It sprang lightly upward two feet to an opening in the trunk where it flapped its wings, struggling to hold position. When presently it came to rest, its left wing was spread across a small branch and its toes were gripping the bark just below the opening. It now thrust its head well into the cavity. When it withdrew its head, we noticed the throat muscles working as in swallowing. The bird now returned to its original position on the branch below, again facing us. This feeding procedure was repeated four or five times. Between feedings the bird gave a low, whining, nasal *kaah* several times. When fluttering into feeding position close against the tree, it displayed the beautiful pattern of the tail and the bold barring and mottling of the under-wings.

"When the hawk had finished feeding, we threw sticks at it and called out, still hoping to watch its flight. It did not budge! Attracted by other birds, we moved up-river, expecting to keep the hawk in sight. But it slipped off without our seeing it go. We did not examine the hole in the tree and can only guess that the hawk may have been robbing a bird's nest or eating wasp or bee larvae, or possibly ants. Certainly no small bird dived at it, or scolded it, while we were watching it."

As for the Blackish Crane-Hawk's nest, eggs, and nesting habits virtually nothing has thus far been published. The following information concerning eggs and the nests from which they were collected is, therefore, of great interest. This information has been furnished me by Mr. Sheffler, who collected the eggs.

"Nest 1. June 4, 1947. Two fresh eggs, plain white, each 53 × 38 mm. Two miles west of Mirasol ranch, southeastern Sonora, at 1800 feet elevation in lowlands below ranch. In Mexican cypress tree in almost dry wash, although some water was running from the larger pools. Nest against main trunk, at highest possible point, and more than 50 feet from ground; like that of Cooper's Hawk (*Accipiter cooperii*) but of smaller sticks, vine stalks, and weeds than that species would use; a few green leaves of wild fig in lining, most of these still clinging to small branches. Very little water anywhere in this area for nine months of the year.

"Nest 2. May 12, 1949. Two eggs, incubated 7–10 days, plain white, 52 × 43 and 52 × 42 mm. At 1800 feet elevation about one mile northeast of Guirocoba ranch-house, southeastern Sonora. In very tall Mexican cypress growing in creek. Creek, running through granite wash, had many pools in

May, but in June was almost dry. These water-courses have, in spots, heavy stands of cypress, large wild fig, morning-glory trees, kapoc, mahogany, and many small Sonora palms, all growing within a few feet of the water itself. Farther back from the water grow thorny, deciduous tropical plants, the giant pitahaya cactus, and other smaller forms of cactus.

"Nest 3. June 3, 1950. One egg, almost ready to hatch, white with several small, distinct spots and four larger, distinct blotches, color Sepia (Ridgway), 50 × 40 mm. At 1650 feet elevation, one and one-fourth miles east of Guirocoba ranch-house, southeastern Sonora. More than 50 feet from ground in very tall Mexican cypress, far out on long limb. Made of rather small sticks and vine stalks lined with small pieces of vine and many green leaves, most of them adhering to small branches. Deeply cupped. Parent bird flushed but not collected.

"Nest 4. June 4, 1950. One young bird about five weeks old [see above] and one egg, the latter plain white, 51 × 41 mm., and addled. At 2100 feet elevation in Tarahumar Mountains, five or six miles southeast of Guirocoba ranch-house, southeastern Sonora. In very high Mexican cypress growing in small dry wash; at least 50 feet from ground, well out on almost horizontal branch. Nest about size of Cooper's Hawk's, but made of smaller sticks than that species would use. Lined with small twigs, grass and weed stalks, some of the twigs bearing green leaves. Remains of coral snake and two lizards along outer edge of nest. Nestling, egg, and male parent collected."

Department of Zoology, University of Oklahoma, Norman, Oklahoma,
November 19, 1954

ANALYTICAL STUDIES OF HENSLOW'S SPARROW SONGS

BY DONALD J. BORROR AND CARL R. REESE[1]

THE song of the Henslow's Sparrow (*Passerherbulus henslowii*) is usually described as consisting of two short buzzy notes. Peterson (1947:231) describes it as "one of the poorest vocal efforts of any bird . . . a hiccoughing *tsi-lick*"; it has been paraphrased *tee-wick* (Jouy, 1881), *flee-sic* (Faxon, 1889), *se-lick* (Hathaway, 1913), and *teesick* (Saunders, 1935, who states that the second note is higher than the first). All these phrases fit fairly well what one hears, but the song is uttered so rapidly that the human ear cannot detect many parts of it. When one listens to a recording played at a reduced speed it is immediately evident that the song contains several notes and is not as simple as it sounds at normal speed. Audio-spectrographic analysis of the song shows that it contains many notes, and it would seem unduly belittling to call such a song the poorest vocal effort of any bird.

Our study of Henslow's Sparrow songs is based on three recordings containing a total of 73 songs: No. 412, recorded in the northern part of Franklin Co., Ohio, April 18, 1953, by Robert A. Lewis; No. 416, recorded in the northern part of Franklin Co., Ohio (about one-fourth mile from where No. 412 was recorded), April 26, 1953, by Carl R. Reese; and No. 492, recorded in the northern part of Delaware Co., Ohio (about 30 miles from the locality of Nos. 412 and 416), May 16, 1953, by the writers. These recordings, now in the writers' collection, were made with a Magnemite recorder, using a tape speed of 15 inches per second.

Vibralyzer graphs (Borror and Reese, 1953) were made of 22 of the 73 songs in our collection. Time measurements were made on graphs prepared using the wide band filter (Figs. 2, 3, 5, 6, 8, and 9); the range of error in these measurements is about 0.001 or 0.002 second (greater in the weaker notes). Frequency measurements were made on graphs prepared using the narrow band filter (Figs. 1, 4, and 7); the range of error in these measurements is about 2 per cent of the range covered by the graph. However, the frequency-wise spread of a note on the graph depends to a considerable extent on the settings on the control panel of the instrument when the graph is made; settings giving a heavy mark result in an apparently greater spread in the frequency, and settings giving a lighter mark result in what appears to

[1]This study has been aided by a grant from the Ohio State University Research Foundation. The authors wish to express their appreciation to Miss Mary Jane Boyle for her assistance in the preparation of the graphs, and to Mr. William M. Protheroe, Dr. Charles A. Shaw, Dr. Robert A. Oetjen, and Dr. Wave H. Shaffer, all of the Department of Physics and Astronomy, Ohio State University, for advice and criticisms during the course of the study.

be a more nearly pure note. In making these graphs we have used a setting which will bring out all or nearly all of the fundamental frequencies present; as a result, the frequency spread in the louder notes may be somewhat exaggerated. The lines that appear at about 2800, 7200, or 7800 cps on some of the graphs are artifacts, due to something in the graphing mechanism and not something in the songs.

Some measure of the relative intensity of different notes or frequencies in a song is given by the darkness of the mark on the graph. Some notes appear to have one frequency of greatest intensity, while in others many frequencies appear equally intense. Another measure of the relative intensity of different notes is given by the readings on the VU meter of the recorder when the song is played (at a reduced tape speed). Loudness in Tables 2–4 is indicated only in general terms, as we cannot at present assign definite decibel values to the different notes. The range from "very weak" to "loud" represents a decibel range of at least 25 db; with a gain setting on the recorder that gives a maximum reading on the VU meter for the "loud" note, the needle does not register the "very weak" note; "fairly loud" is about 5 db below "loud," and with a setting that gives a maximum reading on the VU meter for the "fairly loud" note the needle just barely registers the "very weak" note.

Data on the interval between successive songs are given in Table 1.

TABLE 1

INTERVAL BETWEEN SUCCESSIVE SONGS

Recording	Date Recorded	Time of Day	Total No. of Songs Recorded	No. of Intervals	Range of Intervals (seconds)	Average Interval (seconds)
412	4/18/53	0830	49	42	1.9–5.9	3.04
416	4/26/53	0930	14	12	0.8–1.8	1.21
492	5/16/53	0740	10	8	3.5–7.5	5.22

This interval varied from 0.8 to 7.5 seconds. The different average length of the interval in the three recordings may indicate an individual difference in different birds, or it may indicate—as Hyde (1939) has shown—that the interval later in the season is longer.

CHARACTER OF THE NOTES

A bird's note may consist of a steady output of sound, or of a series of rapid pulses that may be either isolated or connected. Since the silent interval between successive outputs of sound is variable, it is difficult to draw a line between a "note" consisting of a series of isolated pulses and a series of

"notes" each consisting of an isolated pulse or group of pulses. The audiospectrograph is capable of a high degree of time resolution, and can show that what often appears to the ear as a single note actually consists of two or more well isolated sounds. In general, we have used the term "note" for a series of pulses which appear connected when graphed using the narrow band filter, and the term "note group" for a well defined group of such "notes."

A note consisting of a rapid series of connected up-and-down slurred pulses, as in most of the notes of the Henslow's Sparrow songs, is described as a *vibrato* note; a note consisting of a series of individual pulses that are nearly or quite isolated, as in **A** and **F** of Figure 2, is described as a *staccato* note.

Recording No. 492 (Plate I).—Graphs were made of 8 of the 10 songs in this recording, and all are remarkably similar; graphs of two of these songs are shown in Plate I. The song consists of six note groups, which may be designated by the letters **A**–**F** (see Fig. 2). These songs vary in length from 0.300 to 0.305 sec. (average, 0.302 sec.). A summary of the songs graphed is given in Table 2.

TABLE 2

SUMMARY OF SONGS IN RECORDING NO. 492

Note Group	Length (sec.)	Note	Length (sec.)	No. of Pulses	Type of Note	Frequency in cps	Loudness
A	.005–.008	1	.005–.008	2	staccato	9300–10200	very weak
B	.025–.027	1	.011–.014	5–6	vibrato or staccato	8300–9900	not very loud
		2	.004–.005	1	down-slurred	8800–10000	weak
C	.033–.039	1	.014–.019	5–6	vibrato	7000–9000	fairly loud
		2	.005–.007	1–2	staccato	8200–9000	weak
		3	.006	1	up-slurred	8000–8700	weak
D	.041–.044	1	.020–.025	5–6	vibrato	4200–5800	loud
		2	.017–.020	3–5	vibrato	4200–6000	loud
E	.029–.030	1	.014–.017	5–6	vibrato, down-slurred	6500–7800 to 5800–5900	fairly loud
		2	.010–.013	2–3	vibrato, down-slurred	7500–7800 to 5900–6200	fairly loud
F	.032–.038	1	.032–.038	4	staccato, down-slurred at end	5000–5700 to 4800–5800	almost as loud as D

A is an extremely weak note. **B** follows **A** after a silent interval of about 0.040 sec., and is lower in pitch and considerably louder than **A**; it consists of two separate notes, designated in the table as *1* and *2*. In six of the eight songs graphed *1* is a vibrato note (Fig. 2), and in the other two is a staccato note (Fig. 3). **C** follows **B** after a silent interval of about 0.002 or 0.003 sec.; it is somewhat lower in pitch and louder than **B**. It contains three notes, designated in the table as *1*, *2*, and *3*; *2* and *3* are quite weak.

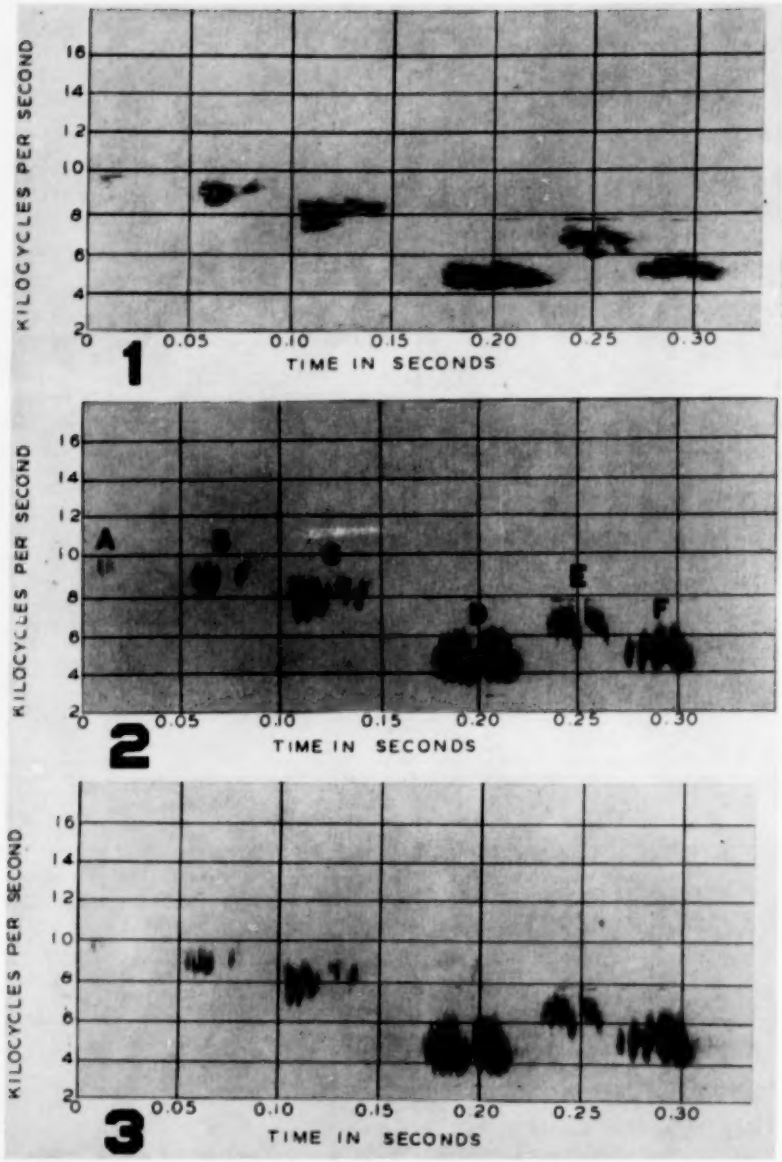

PLATE I. Songs of Henslow's Sparrow No. 492, recorded in Delaware Co., Ohio, May 16, 1953. Fig. 1, the second song in this series, graphed using the narrow band filter; Fig. 2, the same song, graphed using the wide band filter; Fig. 3, the sixth song in this series, graphed using the wide band filter. **A–F**, the six note groups (see text).

D, which follows **C** after a silent interval of about 0.003 sec., is the loudest and lowest in pitch of all the notes in the song; it contains two notes, the first a little longer than the second. **E**, which follows **D** after a silent interval of about 0.015 to 0.020 sec., is a little higher in pitch than **D** but not as loud; it consists of two notes, the first a little longer than the second, and each terminates in a downward slur. **F**, which follows **E** after a silent interval of about 0.010 sec., is almost as low in pitch and as loud as **D**.

By starting a recording at normal speed and gradually decreasing its speed, it is possible to determine what parts of the song the ear detects. The first three note groups (**A**–**C**) are heard as a faint lisp, but only if one listens very carefully. **D** is the first part of the song that is usually heard. **E** and **F**, which come in very rapid succession, are heard as a single, somewhat buzzy note, the *sic* or *lick* of most descriptions; since the frequencies in these notes are for the most part higher than those in **D**, this apparent note (**E** and **F**) appears higher in pitch than **D**, as Saunders (1935) has stated. The songs in this recording sound typical for this species.

Recording No. 412 (Plate II).—Graphs were made of 8 of these songs, and they are very similar to one another and to those for No. 492. The songs in No. 412 contain only five note groups, and some of these groups differ slightly from the corresponding note groups in No. 492. The first note is very much like **A** and the remaining notes resemble **C**–**F** of No. 492; **B** of No. 492 is missing in these songs (Fig. 5). The songs in No. 412 vary in length from 0.223 to 0.230 sec. (average, 0.227 sec.). A summary of the songs graphed is given in Table 3.

TABLE 3

SUMMARY OF SONGS IN RECORDING NO. 412

Note Group	Length (sec.)	Note	Length (sec.)	No. of Pulses	Type of Note	Frequency in cps	Loudness
A	.006–.010	1	.006–.010	2–4	staccato	9000–10000	weak
C	.034–.038	1	.014–.017	5–6	vibrato	7000–9000	fairly loud
		2	.002–.004	1	down-slurred	8600–9600	very weak
		3	.001–.003	1	up-slurred	8000–8800	very weak
D	.040–.050	1	.027–.032	13–15	vibrato	4200–6000	loud
		2	.005–.015	1	staccato	4500–6000	loud
E	.024–.027	1	.012–.017	5–7	up-slurred, vibrato	7000–9000	fairly loud
		2	.002–.004	1	down-slurred	8500–9000	very weak
F	.020–.024	1	.007–.008	1	somewhat down-slurred	5800–7000	fairly loud
		2	.010–.013	3	vibrato	5400–7800	fairly loud

A is rather weak, but is a little stronger than in No. 492. **C** follows **A** after a silent interval of about 0.040 sec., and consists of three notes (*1*, *2*, and *3* in the table); it is lower in pitch and louder than **A**. **D**, which follows **C** after a silent interval of about 0.025 sec., is the loudest in the song and the lowest in pitch; it consists of two notes, the first about twice as long as the second. In one of the eight songs graphed the second note in **D** followed the first after a silent interval of about 0.010 sec., and was only 0.005 sec. in length; in the other seven songs (Figs. 5–6) this second note was

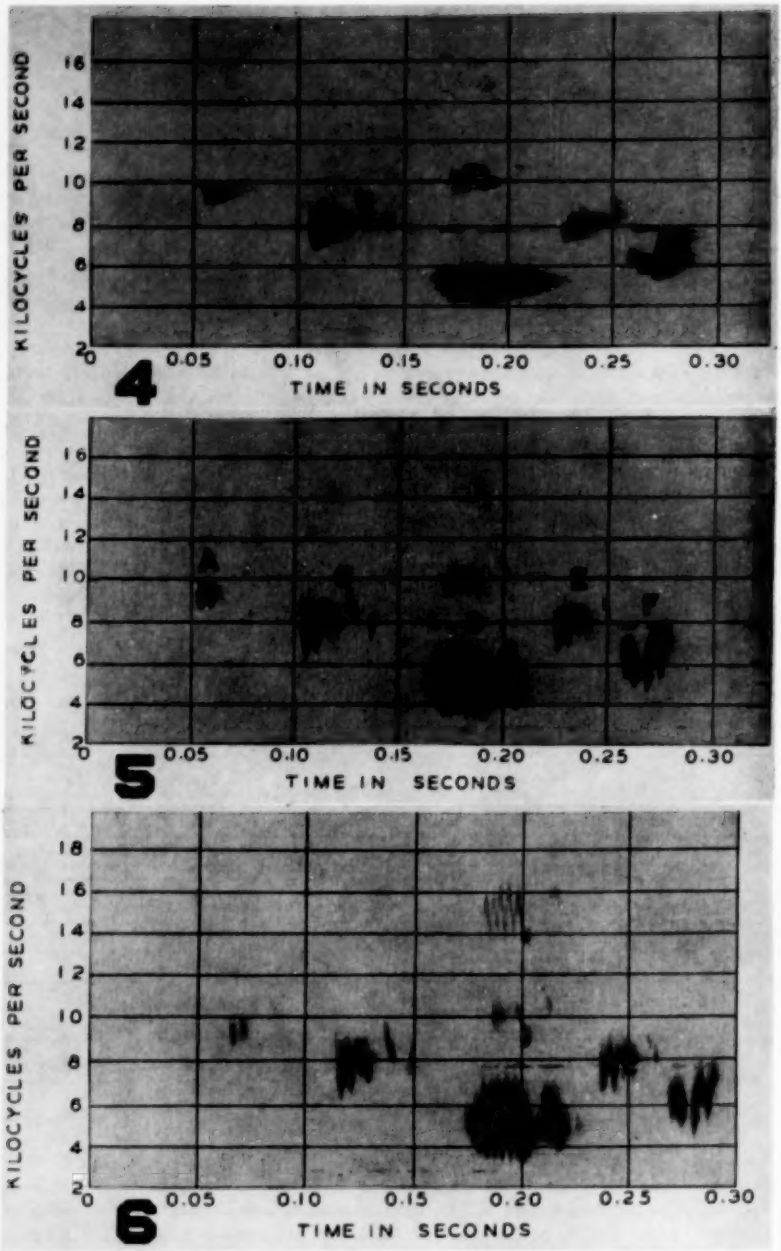

PLATE II. Songs of Henslow's Sparrow No. 412, recorded in Franklin Co., Ohio, April 18, 1953. Fig. 4, the twenty-fourth song in this series, graphed using the narrow band filter; Fig. 5, the same song, graphed using the wide band filter; Fig. 6, the twentieth song in this series, graphed using the wide band filter. **A**, **C–F**, the five note groups (see text).

0.010 to 0.015 sec. in length and followed the first almost immediately. **E**, which follows **D** after a silent interval of about 0.015 sec., is very similar to **C** but lacks the third very short and up-slurred note (*3* in **C**); it has about the same pitch and loudness as **C**. **F** follows **E** after a silent interval of about 0.007 to 0.008 sec., and is the second loudest and lowest in pitch in the song; it contains two short notes.

These songs sound to the ear almost exactly like those in No. 492. The first two note groups are heard as a faint lisp, but only if one listens very carefully. **D** is the first distinct note of the song, and **E** and **F** are heard as a single buzzy note slightly higher in pitch than **D**.

Recording No. 416 (Plate III).—These songs sound a little different to the ear than the songs of the other two birds, and when graphed differ considerably from those of Nos. 492 and 412. These songs consist of four groups of notes, which progressively increase in loudness and decrease in pitch. The first two may be designated **B** and **C**, since they are very similar to the **B** and **C** of Nos. 492 and 412; the third may be designated as **F**, as it is somewhat similar to the **F** in the other two songs; the fourth may be termed **D**, as it is similar to the **D** of the other songs. Graphs were made of six songs of this bird; these songs vary in length from 0.259 to 0.268 sec. (average, 0.262 sec.).

TABLE 4

SUMMARY OF SONGS IN RECORDING NO. 416

Note Group	Length (sec.)	Note	Length (sec.)	No. of Pulses	Type of Note	Frequency in cps	Loudness
B	.021–.029	1	.009–.018	3–4	vibrato	8800–9800	weak
		2	.005–.006	1	down-slurred	9000–9800	very weak
C	.030	1	.016–.020	3–5	vibrato (?)	8000–9500	not very loud
		2	.006–.008	1	down-slurred	8400–9800	not very loud
F	.071–.072	1	.030–.032	3	vibrato and staccato	5800–8500	fairly loud
		2	.015–.019	2	staccato (?)	8100–9000	weak
						8000–8600	
		3	.013–.017	2	vibrato	6400–7600	weak
					staccato	6900–7600	
D	.066–.076	1	.027–.030	10–12	vibrato, up-slurred and down-slurred	3100 to 5800 to 3100	loud
		2	.038–.042	12–15	vibrato, slightly down-slurred	4200–5500 to 3500–4600	loud

B is very similar in its general character to **B** in No. 492. **C**, which follows **B** after a silent interval of about 0.025 sec., is a little louder and lower in pitch than **B**, and contains two notes. **F** is a composite group of notes consisting of a fairly loud principal note (F_1) followed by two very weak notes (F_2 and F_3); **F** follows **C** after a silent interval of about 0.020 sec. F_1 contains three principal pulses; the first pulse contains two groups of frequencies, one of about 6,000–6,800 cps and the other 7,700–8,500 cps (Fig. 7); the second pulse contains frequencies between about 5,800 and 7,100 cps, and

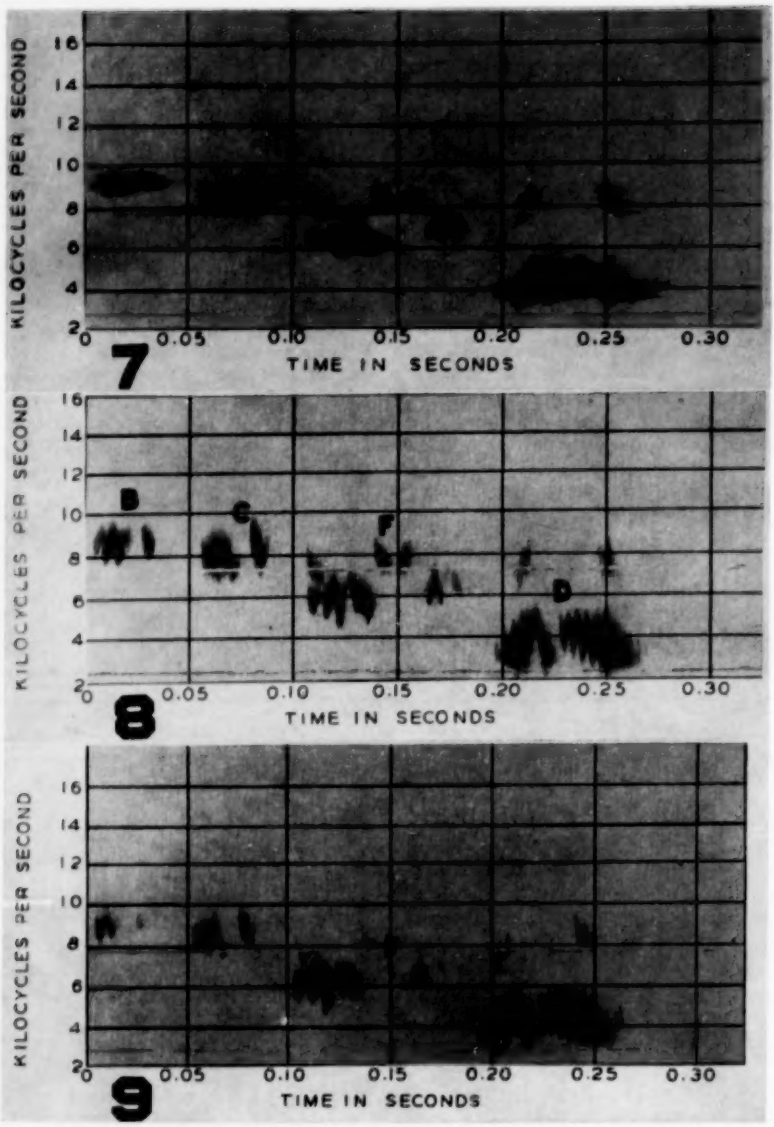

PLATE III. Songs of Henslow's Sparrow No. 416, recorded in Franklin Co., Ohio, April 26, 1953. Fig. 7, the fifth song in this series, graphed using the narrow band filter; Fig. 8, the same song, graphed using the wide band filter; Fig. 9, the second song in this series, graphed using the wide band filter. **B–D, F**, the four note groups (see text).

the third, frequencies between about 5,800 and 7,500 cps. F_2 contains two pulses, the first a little higher in pitch than the second. F_3 contains two pulses. **D** follows **F** after a silent interval of about 0.020 sec., and is the loudest in the song and the lowest in pitch; it consists of two notes, the first a little shorter than the second. The first note in **D** rises in pitch and then falls back rather abruptly; the second note is slightly down-slurred in pitch.

To the ear this song seems to consist of two notes, the first somewhat lisping and the second loud and emphatic; the first appears higher in pitch than the second. The first three note groups (**B**, **C**, and **F**) are heard as a single lisping or buzzy note; **D** is heard as the last emphatic note of the song.

Harmonics

Some of our graphs show what appear to be harmonics; others do not. We believe that all these notes would show a few harmonics if proper instrument settings were used in making the graphs, but a graph designed to show them would distort the fundamental. We have found a weak single harmonic in groups **C** and **E** (not shown in the figures) and weak double harmonics in **D** (Fig. 5) and **F** (not shown in the figures).

Summary

Audio-spectrographs of the songs of three individual Henslow's Sparrows show that the songs are much more complex than they appear to the ear. The song usually consists of a series of two or three note groups of decreasing pitch and increasing loudness, beginning with frequencies around 9,000 or 10,000 cps, and with the lowest frequencies in the lowest note about 3,100 cps. The lowest (and loudest) note in this sequence is usually followed by two fairly loud notes, the first a little higher in pitch than the second, and the second a little higher than the loud note preceding them. The ear seldom detects the first two or three note groups in the song, and the first note usually heard is the loud low note; the last two note groups appear to the ear as the "second" buzzy note of the song. Some of the graphs show what appear to be harmonics for the louder notes. The range in loudness between the weakest and the loudest note of a song represents a decibel range of at least 25 db.

The songs of a given individual are extremely similar, while those of the three individuals are different. The songs of two of the three birds here reported were fairly similar; the third bird had a somewhat different song.

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DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY, OHIO STATE UNIVERSITY, COLUMBUS 10, OHIO, JANUARY 21, 1954

NEW LIFE MEMBER

Horace H. Jeter, a native of Shreveport, Louisiana, and now a practicing Certified Public Accountant in that city, has had a life-long interest in birds and, currently, bird photography. His memberships in ornithological societies include the American Ornithologists' Union, National Audubon Society, Cooper Ornithological Club, and Louisiana Ornithological Society. He is now president of the latter organization and a regular contributor to *Aububon Field Notes*. He is now working on a checklist of the birds of the Shreveport vicinity and is gathering data on song periods of birds.

AN EXPERIMENTAL APPROACH TO THE STUDY OF BIRD POPULATIONS

BY V. E. SHELFORD

THAT the size of bird populations is a matter of interest to ornithologists is evidenced by the publication of *Audubon Field Notes* showing bird counts of various kinds conducted at regular intervals. It is especially praiseworthy that these counts are made of all birds regardless of their value as game or their value or detriment to agriculture. The use that has been made of the counts pays tribute to the efforts of non-professional scientists.

The size of bird (or other animal) populations is the result of the interplay of several factors, but it seems evident that an increase in the number of eggs produced and superior vigor of the young can outweigh normal predation and minor disasters. The simplest cases for testing this statement are those showing the operation of these potent factors during *critical* periods in the annual physiological cycle of the bird. One of these critical periods, which is probably related to the size of the clutch, is the late, rapid development period of the gonads.

What factor acting at this gonadal development period could influence the size of the clutch and the vigor of the young birds? In the case of an insect, a grouse locust (*Acrydium arenesum angustum*), ultraviolet light induces accelerated reproduction (*i.e.*, more offspring) with greater vigor than ordinary "white" light. Without continuous ultraviolet light stimulus over two or more months, this species would not breed in the green house where the work by Sabrosky, Larson, and Nabours (1933) was done. Under somewhat similar circumstances a pair of monkeys was induced to breed in a London zoo by the application of ultraviolet light (Stetson, 1947:181).

Marshall and Bowden (1934:418) greatly shortened the period to oestrous in a ferret by the application of carefully measured ultraviolet light. Oestrous in mammals is the equivalent of egg laying in birds, and since Bailey (1950) announced that ultraviolet light increases egg production by poultry, it seems logical that ultraviolet light may also affect the reproductive rate of other birds as well.

Other factors also may influence the size of clutch. Yeatter (personal communication) states that in the pheasant (*Phasianus colchicus*) clutch size appears to be related to temperature. In work with fish, Merriman and Schedl (1941) found that both strong light and high temperature are necessary for the development of reproductive cells of the four-spined stickleback (*Apeltes quadracus*).

Kendeigh (1944:82) utilized the Christmas bird counts for the state of Ohio to estimate the populations of quail (*Colinus virginianus*) in the entire

state (1908 through 1942). This writer published a curve (Shelford, 1951: 169) showing the intensity of solar ultraviolet for the month of April, 1924–1938, as measured over that period on Mt. Wilson, California by Pettit (International Astronomical Union). When this is drawn parallel to Kendeigh's population curve from 1925 through 1938, it is evident that there is a narrow band of solar ultraviolet which appears to be an optimal range. When intensities were either above or below the apparent optimum range, populations declined. In all years in which April solar ultraviolet was within the optimal limits (102 and 117) there were increases over the quail count of the preceding year. Other studies show (Shelford, 1951:170–173) that moisture also influences quail population, though ultraviolet is most important. Usually two or more factors predominate in controlling fecundity and other physiological processes. Each of us has noted the combined action of temperature and moisture in affecting our sensations on hot, moist and hot, dry days at similar temperatures (Shelford, 1952b:155).

Considerable scientific work on fecundity control of the domestic fowl has been done. Whetham (1933:398) found there were optima of amount of light in connection with activity and suggested that the same principle applied to reproduction. She stated further that light stimulates the production of an internal secretion (anterior pituitary) which activates the ovary (1933:395). She stated that larger consumption of food in the case of birds given additional hours of light is due to the increased egg production induced by more light. Nutrition available is diverted to egg production rather than to the accumulation of fat. She did not suggest that the supply of foods plays no part in the production of eggs, but rather that factors such as deficiency of internal secretion limit the production. When a large supply of the internal secretion is present, egg production may continue for some time in the absence of adequate food supplies at the expense of body weight. A practical example of this was given by Hansson (1930:199) who showed that in one case increased illumination alone, without improvement of an unbalanced ration, resulted in an increase of egg production from 20 to 40 per cent (over controls).

In Fig. 1 the number of pheasant nests per 100 acres in northwest Ohio is shown for the year following the occurrence of the amounts of sunshine (in percentage of the total possible) and rainfall (in inches) indicated for April of the preceding year. This is because young pheasants make nests the year following hatching. Studies of paired factors have led to the drawing of this type of diagram. The drawing of the base of such a diagram is very simple. The intensities of the two factors are scaled on two sides of a rectangle such as Fig. 1. The conditions in a period such as a month, *e.g.*, April, are chosen for study here because of the general knowledge of the reproduction of birds.

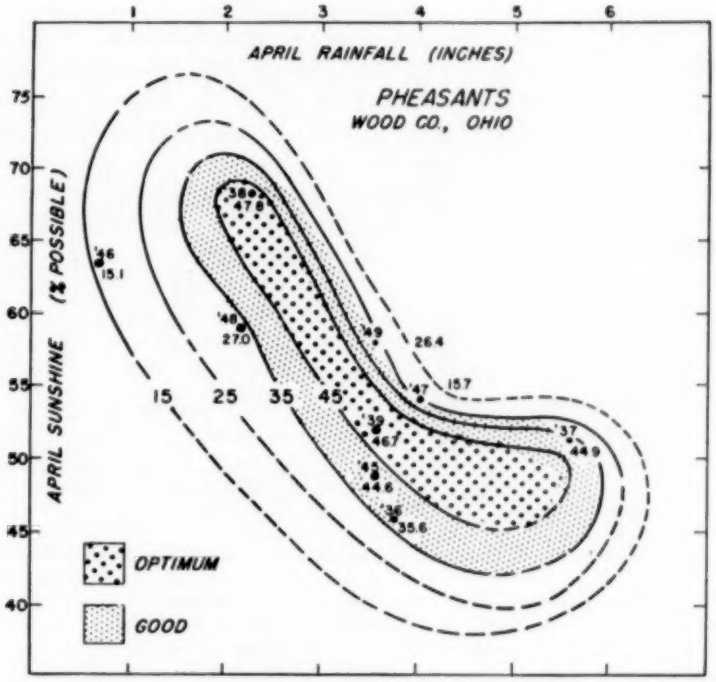

FIG. 1—A heliohydrogram, showing the number of pheasant nests per 100 acres as recorded in northwestern Ohio the year following the one plotted. The numbers are plotted at the intersections of coordinates representing the amount of sunshine in April in percentage of the total possible (recorded at Fort Wayne, Indiana) and rainfall in April (recorded at Bowling Green, Ohio). The interaction of these factors appears to have had an important influence on the size of population. Although for best results these records should have been made in the study area, it is suggested that the same approximate number of nests occurs in series of different combinations of rainfall and sunshine; for example, approximately 47 nests per 100 acres fell on approximately 68 per cent sunshine and 2.25 inches of rain and also on 53 per cent sunshine and 3.5 inches of rain; the data are too few but the ellipses shown follow the general pattern of such relationships. Optimum conditions, based on the largest number of nests, are in the center. The stippled areas indicate two zones of favorability in conditions, and the lines connect years of approximately equal population. Data are from E. Dustman's release No. 203 (1950) of the Ohio Wildlife Research Unit, Ohio State University.

The coordinate points for the two factors are located: for example the 1946 April sunshine was near 63 per cent of the total possible and the rainfall less than an inch. When the coordinated points are all located, the population data are written adjacent to them. The pattern is studied and, if possible, lines con-

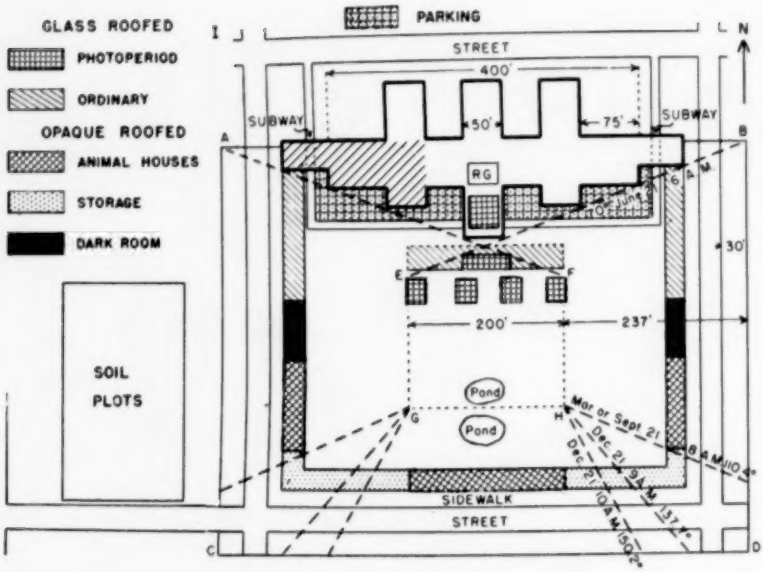

FIG. 2—"Life science" building with a yard at its south enclosed by essential one-story buildings. Area E-F-G-H, a little less than 200 feet square, at 40° N. Lat. has no shadows from 6 a.m. to 6 p.m. when objects 70 feet high are at least 237 feet from its east or west border and a lesser distance from its south border. The dark rooms are for photo-period work. The four small glass-roofed greenhouses are provided without shadow from each other to permit the use of colored glass. The heavy line surrounds the main building which is of interest only in that it casts no shadows on the well lighted area, and supports a roof garden (RG). This is an improvement over the unenclosed plan (Shelford, 1952a). The angles of the sun at various times are shown in the figure, at the right. The corresponding angles for the afternoon are at the left.

necting equal populations are drawn. In this case the figure is good and the apparent discrepancy of 1937 could easily result from a heavier *local* rainfall at the weather station used.

Birds seem to be the ideal vertebrate material for the study of relations of physical factors to fecundity and vigor of offspring. There are good series of domesticated and semi-domesticated species available for study and development of methods which may later be applied to wild species. The size of the clutch is evident in a short time while in the case of mammals there is a long period of gestation.

To be fully valid the final checking of the results of field study, diagrams, etc. should be done out of doors. This raises the question of the requirements of a suitable workshop. Experimental work which involves simulation of na-

tural conditions and the use of variable as well as constant conditions requires the use of out-of-door facilities. Length-of-day effect can be studied by following the practice of some plant laboratories which bring plants from dark rooms into sunlight each day for any period of time desired.

On grounds adjacent to laboratories with dark rooms birds may be subjected to small additions of short or long wave radiation, semi-out-of-doors studies of metabolism may be conducted, and small birds may be trapped under permit. The area for this purpose must be completely enclosed, and essential and useful buildings may best be used to enclose the area (Fig. 2).

Experimental studies call for electrical service, and the use of delicate instruments which cannot be operated away from a laboratory. Birds have been used for considerable basic study in spite of the serious handicaps which have attended some research. With better facilities much more can be done.

The plant shown in Fig. 2 is designed for the biological work of a rather large institution. Because of the unusually favorable character of birds as material for the study of the physiology of reproduction, ornithologists can exert considerable influence toward securing better conditions for experimental work with them, or still better, interest someone in providing the funds to build suitable facilities. Most institutions are not equipped for research such as is needed.

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UNIVERSITY OF ILLINOIS, VIVARIUM BUILDING, WRIGHT AND HEALEY STREETS, CHAMPAIGN, ILLINOIS, AUGUST 15, 1954

AN UNUSUAL MIGRATION OF BIRDS AT TOKYO, JAPAN

BY H. ELLIOTT MC CLURE

WEATHER has long been recognized as a contributing factor in bird migration. In recent years much has been written concerning bird movements and weather in North America (Lowery, 1945; Lincoln, 1950; Williams, 1950, 1952; Gunn and Crocker, 1951, Bullis and Lincoln, 1952; Imhof, 1953; and many others). That the phenomenon of bird movement before "fronts" of weather would not be confined to North America is self-evident. Undoubtedly it is variously reported in the many journals and languages of Europe. Reports of such movements in Japan would be illegible to most American students unless summarized in English. Because of this, I wish to present here observations of a movement of birds before a front that swept over Tokyo on October 31 – November 1, 1953.

Migration through Japan is of long duration, lasting from late July and early August with the appearance of Wandering Tattlers (*Heteroscelus incanus*) and other shorebirds, which have finished nesting in the Arctic, until late December when the last thrushes have come in from Siberia and Manchuria. Because of this there is a continuous flow of birds rather than a great influx. These flights include thrushes, bramblings, bulbuls, etc., reared in the vast continental areas of Siberia and Manchuria, and those more locally produced, from Sakhalin, Hokkaido, and northern Honshu. The continental populations may cross the Japan Sea (Austin, 1947) or move down the chain of islands from Sakhalin. An unknown percentage of these populations remains in Honshu, Kyushu, and Shikoku for the winter, while the remainder moves on down the Ryukyu Island chain to disperse into the Philippines, Formosa, and more southern islands. Since almost no banding has been done these routes and destinations are still poorly understood.

During October first flights of thrushes and bulbuls begin arriving along the northwest coast of Japan. They filter across the island of Honshu especially through the Fossa Magna, the great rift in the chain of mountains forming the backbone of the archipelago. As all of this takes time and is distributed over two months the appearance of migrants and winter residents in Tokyo and vicinity is usually gradual.

Whether the breeding season in Siberia and Manchuria was especially successful in 1953 or whether fall weather conditions in Japan and the land to the north were favorable to migration could not be determined, but flights through Tokyo were definitely more conspicuous than in the three previous autumns which I have observed. The flight of White-rumped Swifts (see tables for scientific names not given in text) had been greater, and that of the

Jay so conspicuous that Jays were found penetrating areas in which they had not previously been seen.

During the day of October 31, 1953, a cold front from a low hanging over the coast of Siberia, Manchuria, and inland moved quietly into Japan bringing with it a light northwest wind and rain. At 1800 hours weather reports indicated that it was raining hard at 10,000 feet and that, unless there was a wind shift, rain would reach Tokyo within an hour. The rain did not come

TABLE I

PERMANENT RESIDENT SPECIES SEEN AT HAMA PARK, TOKYO, DURING THE 1953 FLIGHT

Species[1]	*Oct. 6*	*Nov. 2*	*Nov. 9*
Common Cormorant (*Phalacrocorax carbo*)	200	41	7
Black-crowned Night Heron (*Nycticorax nycticorax*)	3	6	
Black-eared Kite (*Milvus migrans*)	3	2	4
Bamboo Partridge (*Bambusicola thoracica*)[2]	2	2	2
River Kingfisher (*Alcedo atthis*)	3	1	2
Thick-billed Crow (*Corvus levaillantii*)	1	2	2
Great Tit (*Parus major*)	4	10	17
Gray Wagtail (*Motacilla cinerea*)	2	1	1
Bull-headed Shrike (*Lanius bucephalus*)	1	8	8
Ashy Starling (*Sturnus cineraceus*)	103	43	68
Tree Sparrow (*Passer montanus*)	106	40	120
Oriental Greenfinch (*Chloris sinica*)		10	1

[1]Common and scientific names from Austin and Kuroda, 1954.
[2]Introduced in 1919 from China and now a widespread and permanent resident.

as the front veered off to the north and a high with clear skies and a light, warm, southeast wind pushed over the coast. All day November 1 the warm, clear weather held, but it became calm at sundown and by 2100 hours the wind had shifted again to the northwest and the cold weather moved in. It was raining and windy all day November 2.

There was nothing unusual about this chain of events in the weather. It happens regularly in the humid, rainy climate of Tokyo, but this time a host of birds was moving with the cold front and they were momentarily stranded by the warm weather which intercepted them.

In the light of the huge flocks of birds that may be seen in America—large both in numbers and species—those encountered in Tokyo seem insignificant. However, the weather-bird relationship was present even if on a small scale.

Within the limits of downtown Tokyo is a small, heavily wooded park of about forty acres, Hama Park. An island formed by reclaimed mudflats between canals and Tokyo Bay was established at least a hundred years ago as a private bird sanctuary and hunting ground for the Imperial Household but is now a city park. About one-third of the area is made up of ponds and landscaped lakes. The remainder is about equally divided between lawns and

clumps of large trees, oaks, camphor, pines, and others, with a heavy undergrowth of bamboo and ornamental shrubs. Because of its proximity to the city, it is heavily used by pleasure seekers, and the mild weather of November 1 filled the parks with thousands of people.

Observations were made on the morning of November 2 before the bulk of the birds had moved on, and on November 9, when more normal winter populations were present. These observations are compared here with those made on October 6 (Tables 1, 2, and 3). Of the 37 species seen during these three observations, 12 were permanent residents of the park. These are listed in Table 1. There was nothing unusual about the numbers seen. The Ashy Starling, Tree Sparrow, and Cormorant numbers fluctuated because of their daily movements to and from the park. However, the sudden increase in Bull-headed Shrikes seemed to be correlated with the cold front.

TABLE 2

WINTER RESIDENT SPECIES AT TOKYO, JAPAN, APPARENTLY INFLUENCED BY THE FRONT OF OCT. 31 – NOV. 1, 1953

Species	*Oct. 6*	*Nov. 2*	*Nov. 9*
Snowy Egret (*Egretta garzetta*)	1	6	3
Spot-billed Duck (*Anas poecilorhyncha*)	2		10
Green-winged Teal (*Anas crecca*)			2
Black-tailed Gull (*Larus crassirostris*)	1	58	2
Black-headed Gull (*Larus ridibundus*)		28	42
Turtle Dove (*Streptopelia orientalis*)	1	3	4
Brown-eared Bulbul (*Ixos amaurotis*)	7	105	15
Bush Warbler (*Horeites diphone*)			13
Pied Wagtail (*Motocilla alba*)		2	2
Hawfinch (*Coccothraustes coccothraustes*)			2
Black-faced Bunting (*Emberiza spodocephala*)		4	1

Migrating flocks of winter residents (Table 2) were most evident in this population shift. The Brown-eared Bulbul is a noisy, conspicuous winter resident which arrives in October. It is the only passerine species in Japan which flocks as do blackbirds in America and can be seen sweeping like smoke above the horizon. Ordinarily, winter flocks of bulbuls are common in Kyushu but very uncommon in the Tokyo area. On November 1 and 2 a group of more than a hundred bulbuls formed a loose flock which flew restlessly above the trees of the park, diving into them every few minutes to feed. Other winter residents listed in Table 2 arrived with the front or in the weather immediately following it.

Strictly migrant species at this season were apparently brought into or moved away from the Tokyo region by this front (Table 3). The Jay went on south with the storm. Flycatcher and warbler migration was brought to a close. Thrush flights apparently just began with this front and could be ex-

TABLE 3

MIGRANT SPECIES SEEN AT HAMA PARK, TOKYO, IN THE FALL OF 1953

Species	*Oct. 6*	*Nov. 2*	*Nov. 9*
Mangrove Heron (*Butorides striatus*)	1		
Common Sandpiper (*Actitis hypoleucos*)			1
Brown Hawk-Owl (*Ninox scutulata*)	1		
White-rumped Swift (*Apus pacificus*)	6		
Jay (*Garrulus glandarius*)	5	3	
Pale Thrush (*Turdus pallidus*)			4
Red-bellied Thrush (*Turdus chrysolaus*)		4	
Blue Rock Thrush (*Monticola solitarius*)			1
Redstart (*Phoenicurus auroreus*)			1
Crowned Willow Warbler (*Phylloscopus occipitalis*)	1		
Broad-billed Flycatcher (*Musicapa latirostris*)	9	1	
Gray-spotted Flycatcher (*Musicapa griseisticta*)	3		
Narcissus Flycatcher (*Siphia narcissina*)		1	

pected to increase slightly before they moved on. All of the birds listed in Table 3 are of interest, but two species, the Common Sandpiper and the Mangrove Heron were summer stragglers that should have flown weeks before. The Redstart, a small thrush, moved in during the week but probably did not winter in the park as they usually frequent more open or brushy farmlands.

The Blue Rock Thrush, a beautiful robin-sized bird of powder blue and brick red, is a species of very limited habitat requirements. It is found most commonly along rocky coasts where it nests beneath the rocks and feeds along the water's edge. Each year of my studies a lone male has been seen on a small, unused lighthouse at Hama Park, many miles from any suitable habitat. Fall arrival dates have been October 4, 1951, October 6, 1952, and November 9, 1953. It would have been of interest to have determined the identity of this annual visitor by banding.

On November 16, another front of about the same magnitude as that of October 31 – November 1 swept over Japan, bringing another wave of birds. On the following day tallies were made at an upland farm area in the outskirts of Tokyo. This was in rolling country of open fields surrounding farmyards of large trees and bamboo thickets. Again migrant forms were much in evidence, including Bull-headed Shrikes, Brown-eared Bulbuls, Dusky Thrushes (*Turdus naumanni*), Oriental Greenfinches, Redstarts, Hawfinches, Rustic Buntings (*Emberiza rustica*), and a lone Eurasian Woodcock (*Scolopax rusticola*).

SUMMARY

A mild, cold front on October 31, 1953, stalled at Tokyo, Japan, by a warm front for twenty-four hours, brought a flight of migrants which re-

mained a few days. The most conspicuous of these was the Brown-eared Bulbul. Other species apparently arriving at this time were the Bush Warbler, Pale Thrush, Red-bellied Thrush, and Redstart. Most species moved on as the cold front overran the warm front and pushed on south. A second migratory wave appeared two weeks later with another front.

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406th Medical General Laboratory, APO 500, c/o Postmaster, San Francisco, California, December 3, 1953

GENERAL NOTES

The effect of radar on birds.—The publication of this war time observation was delayed pending the removal of security classification from the equipment used. Recently, the United States Air Force dropped this radar from the restricted list, permitting the publishing of the characteristics of the equipment, without which this report would be of little value to investigators in the field of avian orientation.

In the fall of 1943, I was in charge of a group of military personnel engaged in tracking aircraft over the ocean off the east coast of the United States. The radar set was emplaced in the dunes not far from the high tide line. During a lull in operation, a large flock of scaup (*Aythya* sp.) and scoters (species?) was seen flying parallel to the coastline a few hundred yards off shore and approaching our position. Having nothing better to do at the moment, we idly swung the parabolic antenna around and pointed it directly at the flock. The result was immediate and dramatic. The once orderly group of birds became a bewildered mass of individuals which flew in circles, missed wingbeats, and performed many unbirdlike gyrations. Some observers later insisted that a few birds accomplished loops and rolls although I never observed this. As the beam was diverted by elevating the antenna, the flock regrouped and proceeded down the coast in the original direction.

To verify this unusual behavior as being caused by radar, the experiment was repeated several times on subsequent occasions. In each case, the result was essentially the same, the response of the stimulated flock coinciding with the incidence of the beam upon the birds, the cessation of response coinciding with the diversion of the beam. The intensity of reaction appeared to vary inversely with the distance between the radar and the birds and some individuals were affected more than others. There also seemed to be some relationship between the angle of incidence and the intensity of response but this was not clear.

The electrical characteristics of this radar are quoted for those working in this field: wave length 10 centimeters (3,000 megacycles), crystal controlled; peak power 210 kilowatts; average input 540 watts; average output 280 watts; pulse recurrence frequency 586; pulse width 0.8 microseconds; beam width 1.4 degrees; maximum range 70,000 yards.

Although it is not the purpose of this report to speculate upon the nature of the mechanism involved in the detection of electromagnetic radiation by birds, one cannot help but wonder if the behavior described above does not support the theory that birds indeed perceive the earth's magnetic field. In flight, the crossing of these lines of force may result in the production of phosphenes, or perhaps the answer lies in the setting up of tiny oscillating currents somewhere in the animal's central nervous system.—O. A. Knorr, *Department of Biology, University of Colorado, Boulder, Colorado, April 20, 1954.*

Evening flights of the Southern Everglade Kite and the Blue and Yellow Macaw in Surinam.— The Southern Everglade Kite (*Rostrhamus s. sociabilis*) is, in the coastal area of Surinam, a common bird in freshwater marshes. It is often seen on poles or fences along rice fields, on the lookout for snails. This habitat it shares with the Southern Limpkin (*Aramus g. guarauna*), in Surinam called "Krau-krau," after its call note which is a characteristic sound at night or in the early morning in these places. The rice fields are only feeding areas where, owing to lack of cover, the birds are unable to breed.

The Everglade Kite is particularly numerous in the rice-growing district, Nickerie,

on the right bank of the Corentyne River. I never located a breeding colony, but the breeding season must be in the long rainy season as I observed birds assembling and carrying nest material on May 29 and 30, 1953, along Huntley Creek, in the same district where both kites and limpkins were numerous in the vast, surrounding marshes. As is well known, the Everglade Kite is a very social bird which spends the night in a communal roost. In Nieuw Nickerie I observed every afternoon a number of kites crossing the Nickerie River to its right bank on their way to their roost which itself remained unknown to me. At the end of July the numbers were particularly large, so I took the opportunity to count them on July 31, 1953.

The flight started at about 5:30 p. m. They passed over at low altitude, slowly flapping their wings, alternating with short glides. Many were in immature plumage, those in adult plumage often having the primaries in molt. It was interesting that several carried single snails, either in their claws or in their bills. The flight stopped towards darkness, or at about 6:45 p. m. I counted 712 birds which certainly were not all as the birds passed over a rather broad front which I could not oversee in its entirety. It was an impressive spectacle, as at the same time a large number, running into a few thousand, of egrets passed over in the same direction. These egrets have a long-used roost in the bushes on the right bank of the Nickerie River just opposite Nieuw Nickerie.

The Blue and Yellow Macaw (*Ara ararauna*) is in Surinam a bird of the lowland forests. Here it breeds in dead Moriche palms (*Mauritia flexuosa*). Kappler (1881. "Holländisch Guiana," Stuttgart, p. 94) reports the finding of a nest with two eggs (no date given) in such a situation, along the Wana Creek in the Maroni District. A favorite food is the seeds of the possentri or poison tree (*Hura crepitans*). On December 17 and 18, 1948, in the Coronie District, I watched a number of birds feeding in these trees and the stomach of a specimen collected at that time was full of the seeds.

Through the clearance of forests it has now entirely disappeared from the neighborhood of Paramaribo, but it is still rather common wherever primitive conditions remain. I have seen it regularly when travelling by launch along the upper Nickerie and Wayombo rivers and it is always a magnificent sight when some birds, always flying in pairs, cross the forest-fringed rivers, from time to time uttering their harsh note, *rrrraaa*.

The most impressive spectacle, however, I witnessed on August 23, 1947, when travelling by launch downstream on the Coppename River. In the late afternoon, beginning at about one hour before sunset, numbers of *Ara ararauna* started crossing the river towards its left bank at the point where the Tibiti River enters the Coppename.

As so often happens in such cases I realised the opportunity to count the passing birds only after the spectacle was already well under way. The birds were, as usual, in pairs, each pair flying with slow, synchronised wing strokes, the birds close to each other. Sometimes only single pairs went over, followed again by loose flocks split up in pairs.

The total counted was 342 birds. This number was certainly not all which crossed, as I started counting when the flight had been in progress for some time and, further, I counted from a rather fast-moving boat. In reality at least twice this number must have crossed the river at that time, en route to a sleeping place in the midst of the forest.—F. Haverschmidt, *P.O. Box 644, Paramaribo, Surinam, August 26, 1953.*

Repeated territorial attacks of Pied-billed Grebe on Ring-necked Duck.—In the course of early morning observations on Pied-billed Grebes (*Podilymbus podiceps*) which began on February 27, 1954, one grebe, believed to be a male, established a territory in a marshy pond in Seneca, Maryland. By April 3, this bird had a mate, and

courtship activities, similar in general to those described for the previous year (Kilham, 1954. *Wilson Bull.*, 66:65), were observed. On March 27, Coots (*Fulica americana*) were diving in open water at the center of the grebe's territory. A single female Ring-necked Duck (*Aythya collaris*) alit among the Coots and immediately began to dive. Suddenly the duck flew ten feet over the surface as the grebe emerged at the spot where she had been. The grebe then dashed at the duck which flew to the other end of the pond. Thereupon the grebe called *ka, ka, cow, cow,* etc., the sides of its neck swelling and collapsing as it did so. On March 28, the female ring-neck was again diving with the Coots while the grebe was thirty feet away. Suddenly the duck flew over the surface a short distance, then swam rapidly away, the grebe having come up where she had first been startled. Five minutes later the ring-neck had returned and was again attacked from below and pursued a short distance. A longer lull of twenty minutes followed in which the Pied-billed Grebe was lost from view in marsh vegetation and the ring-neck swam back to continue diving. As I watched (7 × 50 Zeiss binoculars), the duck suddenly started swimming, half submerging as she did so. I could not see the grebe. After swimming twenty feet the duck took flight as the grebe emerged where the former had taken wing. Ring-necked ducks were not found on subsequent visits to the pond. In the four episodes witnessed, the grebe had attacked under water from some distance away and with surprising swiftness. On April 3 a similar attack was launched against an immature Pied-billed Grebe which had no clear bill markings. I saw the male grebe sink under water and, as traced by over-lying ripple marks, head for this stranger. Meanwhile the immature bird, as if alerted, had begun to swim away at right angles. The male surfaced where the other grebe had been, then made a dash which caused the immature bird to take flight. Few other grebes were seen on the pond during the weeks it was under observation.

To test the male grebe's reactions I threw a small duck decoy, painted roughly like a female Ring-necked Duck, into his territory. Ten minutes later he swam up to within twelve feet of this lure and gave a loud *ka, ka, cow, cow,* etc. Then with head and neck stretched straight up like a periscope to see above the weeds, he approached to within six feet, looked the decoy over well, and departed. This curiosity was evoked in varying degree on subsequent occasions by a stoppered bottle thrown into the open water, a muskrat cleaning its fur on a tussock, and by any sudden commotion among the Coots or Blue-winged Teal (*Anas discors*). The grebe never showed hostility toward teal, Coots, or Wood Ducks (*Aix sponsa*) which were usually present and often passed the grebe at close range.

On April 17, a female Hooded Merganser (*Lophodytes cucullatus*) flew over and alit in open water where all previous attacks had been witnessed. I kept my binoculars on the merganser after it alit. Within seconds the duck shot eight inches straight upward with *quack, quack* of alarm as the grebe surfaced right below. To all appearances the grebe had rammed the merganser in the belly. The merganser alit 15 feet farther on and the grebe swam for it with neck arched and head low, causing the merganser to fly twenty feet still farther on. Although the duck continued to swim and dive in the grebe's territory, the latter paid no further attention to it. On this, as on other occasions, the female grebe, although nearby, was never observed to attack.

Discussion: In the above observations the so-called male was distinguished from the female grebe by a lighter back (presumably an individual variation), by being the one to establish the territory, by delivering all attacks observed, by making the only loud, prolonged calls, and, on two occasions, by performing the "courtship dance" of standing on water with rapidly treading feet, a performance which immediately preceded coition

in my study previously referred to. Attacks delivered under water in an attempt to ram an adversary from below are of interest as they have been described for other species of grebes. Of special interest, however, were the repeated attacks on the female Ring-necked Duck, in explanation for which the following hypothesis is offered: When seen together it was apparent that the female ring-neck bore rough resemblances to a Pied-billed Grebe, both in color pattern and behavior. It is a small duck with a ring on its bill and a white eye ring. It is dark brown above and lighter buff below. In behavior, it dove frequently and repeatedly lifted its body at a forty-five degree angle to the surface to shake and readjust its plumage, thus exposing its white belly. The grebe, when diving, has a similar performance, but has a peculiar way of snapping back to its original position. The female Ring-necked Duck may have had sufficient "releasers" to elicit attacks which the male grebe would normally have launched only against rivals of its own species. The ring on the bill may not have been the principal "releaser" as an immature grebe and a female Hooded Merganser were also attacked. The merganser, with its distinctive reddish crest, was only attacked momentarily, possibly on account of its small size and drab color. Once the grebe had a closer look, however, no further attacks were made. In summary, the male Pied-billed Grebe was perpetually alert to activities of other birds and animals in its territory, attacking what it considered rivals, but showing well-marked curiosity toward new situations.—LAWRENCE KILHAM, *8302 Garfield Street, Bethesda, Maryland, April 25, 1954.*

Miscellaneous notes on Mexican birds.—During the past several years the California Academy of Sciences has secured several thousand study skins of birds from various parts of Mexico. Most of these were either purchased from the late Wilmot W. Brown or obtained by the senior author. Smaller accessions were received through the courtesy of Drs. Ernest P. Edwards and G. Dallas Hanna. Included in these collections are certain new state records and extensions of the ranges of a few species. In the course of studying some of this material it was necessary to examine pertinent specimens in the University of California Museum of Vertebrate Zoology and the University of Kansas Museum of Natural History. The writers are indebted to the officials of these institutions for permission to examine collections under their care and to make mention of certain specimens found therein.

Podilymbus podiceps antillarum. Pied-billed Grebe. A male taken by Webster on a pond 12 miles northeast of Durango City, Durango, June 26, 1952, was paired and apparently breeding. Its testes were enlarged. The wing length (120 mm.) is equal to the minimum listed for males of this race by Hellmayr and Conover (1948. *Field Mus. Nat. Hist., Zool. Ser.*, 13, pt. 1, no. 2:37). This species has heretofore neither been reported from Durango nor have members of this race been recorded this far north.

Falco columbarius richardsonii. Pigeon Hawk. An adult female, taken January 28, 1952, near Chilpancingo, Guerrero, and prepared by W. W. Brown, appears to be of this race. It is decidedly paler above and below than any comparable examples of either *F. c. columbarius* or *F. c. bendirei* examined. This not only constitutes a considerable southward extension of the wintering range of the race *richardsonii* but also the first record for this species from Guerrero.

Catoptrophorus semipalmatus inornatus. Willet. An adult female secured at the north end of Socorro Island on November 20, 1953, by G. Dallas Hanna, is the first record of this species from the Revillagigedo Islands.

Crocethia alba. Sanderling. A single female was seen and collected by G. Dallas Hanna at the north end of Socorro Island, Revillagigedo Islands, on November 20, 1953.

This species is not recorded from these islands by Friedmann, Griscom, and Moore (1950. *Pac. Coast Avifauna*, 29:99).

Coccyzus americanus. Yellow-billed Cuckoo. Two adult males were secured by W. W. Brown near Chilpancingo, Guerrero, one on October 1, 1950 and the other on September 1, 1952. The wing measurements (145 and 146 mm.) of these two specimens are such as to leave doubt regarding subspecific identity. Friedmann, Griscom, and Moore (*op. cit.*:132), however, do not record this species from Guerrero.

Otus scops flammeolus. Scops Owl. This species has not, heretofore, been recorded from Guerrero. A female, secured December 25, 1950, near Omilteme by W. W. Brown exhibits none of the characters assigned by Griscom (1935. *Ibis*:549) to the race *guatemalae* (=*rarus*). It is actually grayer and exhibits paler ochraceous markings than 9 specimens of *flammeolus* examined from southern Arizona.

Asio flammeus flammeus. Short-eared Owl. On February 11, 1950, W. W. Brown secured a female Short-eared Owl near Omilteme, Guerrero, which, so far as known, is the first record for that state.

Sayornis nigricans nigricans. Black Phoebe. One was seen by Webster at Arroyo Mimbres, Durango, on June 18, 1950; and on June 21, 1952 two adults and an immature were seen at a small tank near Nombre de Dios in the same state. The immature, which was collected, has the blacker crown and black shaft streaks on the under tail coverts characteristic of the more southern race, *S. n. nigricans*, rather than *S. n. semiatra*. Although Miller (1906. *Bull. Amer. Mus. Nat. Hist.*, 22:168) recorded this species from Durango under the name *S. n. nigricans* the present concept of this race is considerably different (cf. A. O. U. Check-List Supplement 20, *Auk*, 1945, 62:443) and its northern limits are not clearly known.

Contopus virens placens. Wood Pewee. An immature male was taken July 25, 1950, at 5,000 ft., 10 miles east of Mezquital, Durango, by Webster. This race has not previously been recorded from the state.

Auriparus flaviceps ornatus. Verdin. The southernmost published records for the Verdin are from Saltillo, Coahuila, by Burleigh and Lowery (1942. *Occas. Papers Mus. Zool. Louisiana State Univ.*, 12:197) and near Fresnillo, Zacatecas, by Webster and Orr (1954. *Condor*, 56:157). There are two specimens in the University of Kansas collection from Jalisco (2 miles west-northwest of Lagos de Moreno, 6,390 ft., August 12, 1949) and one specimen in the same collection from San Luis Potosi (10 miles northeast of San Luis Potosi City, 6,000 ft., July 29, 1950). We believe that the range of the species in Mexico will eventually prove to be coextensive with the ranges of the "Desert" and the "Mesquite Scrub" as mapped by Leopold (1950. *Ecology*, 31:507–518).

Sitta carolinensis umbrosa. White-breasted Nuthatch. The species has been reported from Sinaloa by Hawbecker (1948. *Condor*, 50:28), who did not, however, give a racial identification. We consider this specimen (California Academy of Sciences collection), a male from Pinos Gordo, taken September 30, 1934, to be *S. c. umbrosa.*

Certhia familiaris albescens. Brown Creeper. The species has not previously been recorded from Sinaloa. We have examined six specimens from that state: a female from El Batel, October 15, 1946, and a male from El Batel, October 14, 1946 (both in the Museum of Vertebrate Zoology); a male from Pinos Gordo, September 22, 1934, and three females from the same locality taken September 24 and 27, 1934 (California Academy of Sciences collection).

Anthus spinoletta pacificus. Water Pipit. A female secured on the north end of Socorro Island, Revillagigedo Islands, on November 20, 1953, by G. Dallas Hanna, resembles wintering specimens of *A. s. pacificus* from central California.

Vireo huttoni carolinae. Hutton Vireo. The breeding form of Durango has in the past

been referred to *V. h. stephensi*, most recently by Hellmayr (1935. *Field Mus. Nat. Hist., Zool. Ser.*, 13, pt. 8:120). Two specimens taken by Webster in 1952, 15 miles west-southwest of El Salto (a female with an egg in her oviduct, June 23, and a male, June 24), as well as two specimens in the Museum of Vertebrate Zoology (a male from 4 miles southwest of El Salto, June 26, 1952, and a male from Resolana, near the Chihuahua border, June 23, 1952) we refer to the darker, less green, race of north-central Mexico.

Dendroica auduboni nigrifrons. Audubon Warbler. The most southerly breeding area reported in the literature is extreme southern Chihuahua by Moore (1946. *Auk*, 63:241–242). Actually, the species seems to breed commonly in southern Durango, and probably even farther south. Singing males were taken by Webster at Hacienda Coyotes, 8,200 ft., 7 miles northeast of El Salto, Durango, June 27, 1950, and June 24, 1952. The former specimen had testes 4 mm. long; the latter was in full breeding condition, with testes 10 and 9 mm. long and cloaca (seminal vesicles) enlarged with sperm.

Dendroica graciae graciae. Grace Warbler. On June 25, 1952, Webster observed an adult female feeding two immatures in the pines above Arroyo Mimbres, Durango, 8,000 ft. All three birds were collected. We have previously (Webster and Orr, 1952. *Condor*, 54:311) reported a sight record from the same area, but this is the first specimen to be recorded from the state.

Sporophila minuta parva. Ruddy-breasted Seedeater. An adult male was secured by Ernest P. Edwards, July 24, 1952, at Pie de la Cuesta, near Acapulco, Guerrero. The testes measured 5 and 6 mm., respectively. Edwards saw several other individuals that day, and Webster saw a single male at the same place on July 26. This species has previously been recorded in Mexico only from the states of Nayarit, Oaxaca, and Chiapas.

Loxia curvirostra stricklandi. Red Crossbill. Two red males in nonbreeding condition were taken by Webster on June 23 and 24, 1952, 15 miles west-southwest of El Salto, Durango, from several small flocks seen. There is no previous record from the state.

Aimophila ruficeps simulans. Rufous-crowned Sparrow. Since the description of this race by van Rossem (1934. *Bull. Mus. Comp. Zool.*, 77:486-487), determination of specimens from Sinaloa and southern Durango has not been reported. There are two males in the Museum of Vertebrate Zoology taken October 14 and 16, 1946, at El Batel, Sinaloa. Webster took a breeding pair on June 22, 1952, six miles west of Durango City, Durango, at 7,200 ft., in mesquite grassland; his only Durango sight records were from the same area.

Aimophila cassinii. Cassin Sparrow. On July 10, 1952, an adult male in full breeding condition (testes 7 and 6 mm. long, cloaca enlarged and full of sperm) was taken by Webster in San Luis Potosi. The bird sang a typical flight song and exhibited territorial behavior. The locality was 24 miles northeast of San Luis Potosi City, at 5,900 ft., in mesquite grassland with a good growth of new grass. We find no previous records in the literature of the Cassin Sparrow from this state.—J. Dan Webster and Robert T. Orr; *Hanover College, Hanover, Indiana; California Academy of Sciences, San Francisco, and University of San Francisco, California, March 5, 1954.*

English Sparrow seeks refuge in ground burrow.— Several large outside cages are maintained in connection with the Ornithological Laboratory at Ohio State University. Some of these cages are 16 × 10 × 8 feet in size and are covered with one inch mesh poultry netting. They are used to confine such birds as ducks and pheasants. The doors on some of the cages are slightly sprung out at the bottom, and English Sparrows (*Passer domesticus*) enter and leave through the holes thus formed. A Norway rat also entered one of the cages and dug a burrow into the ground beside the rat-proofing wire which is buried around the edge of the cage.

It was sometimes possible to enter the cages and to capture the English Sparrows with an insect net before they escaped through their entrance hole or through the mesh of the chicken wire. Normally, I entered the cages and concentrated my efforts on a chosen bird until it was captured; then effort was shifted to a second bird if one were present.

On February 18, 1954, a cage contained two English Sparrows, and I readily captured one of these birds in a net. The second was pursued from one end of the cage to the other several times before it plunged to the ground and disappeared into the rat burrow at the corner of the cage. I waited several minutes about 10 feet from the burrow for the bird to reappear, but it remained hidden. I withdrew, therefore, to a distance of some 20 feet from the burrow and waited. After about five minutes, the bird came out of the burrow. It paused a few inches from the entrance and remained there several minutes while I watched. I then disappeared from the bird's view and watched from concealment. After several minutes, the English Sparrow moved farther from the burrow and flew about the cage. I then rushed into the cage with the net only to see the bird immediately return into the burrow. This procedure was repeated two more times without my being able to capture the English Sparrow. It was only by waiting a half hour and then rushing into the cage that I was able to outwit this bird.

A second English Sparrow showed closely similar behavior. This bird escaped into the room from the small cage in which it was confined inside of the bird laboratory. When it was pursued, it soon disappeared somewhere among the equipment stored in an adjacent room. Food and water were available in the room, and this bird remained free therein through the following several weeks. Repeated unsuccessful efforts to capture it were made. Whenever I entered the laboratory, it flew directly into the small adjacent room and hid among equipment which could not conveniently be moved. After about a month it was permitted to escape through an open door.—PAUL A. STEWART, *Ohio Cooperative Wildlife Research Unit, Department of Zoology and Entomology, Ohio State University, Columbus, June 21, 1954.*

Barn Owl hunting by daylight.— At 3:00 p.m. on January 23, 1954, Francis Cormier of Hartsdale, New York, Terry Hall of Scarsdale, New York, and I observed a Barn Owl (*Tyto alba*) hunting over Tobay Beach Bird Sanctuary near Jones Beach, Long Island, New York. We watched the bird for about 15 minutes, during which time the sun was bright although the sky was slightly hazy.

The owl had a distinctive hunting pattern, which we saw it repeat four times: After flying at an altitude of 15 or 20 feet for about 50 yards over bayberry (*Myrica cerifera*) and scattered Japanese black pine (*Pinus thunbergi*) habitat, it would climb to 30 feet and hover for about half a minute. Slowly losing altitude, it would suddenly plunge to the ground. Consistently catching nothing, it would fly into a two or three acre Japanese black pine grove or perch on an 8 foot high sign post at the edge of the grove.

While hovering, the owl's long legs hung directly downward, its head was directed downward at an angle of about 35 degrees from its horizontal body, and its wingbeat was approximately one-third as rapid as that of a hovering Sparrow Hawk (*Falco sparverius*). While the owl was hunting, a light-phase American Rough-legged Hawk (*Buteo lagopus*) passed within 50 feet of it. Neither bird, however, outwardly reacted to the other.

The owl's intended prey was probably the meadow vole (*Microtus pennsylvanicus*), which occurs abundantly in the area. On February 28, 1954, 200 yards from where we had observed the owl hunting, Terry Hall and I found three Barn Owl pellets containing four skulls of meadow voles.—KEN HARTE, *45 Laurence Road, Scarsdale, New York, April 2, 1954.*

Swimming by wild Turkey poults.—In mid-afternoon, May 14, 1954, Martin, a game management agent of the U.S. Fish and Wildlife Service, and J. H. Parsons, district supervisor of State conservation officers, were on routine patrol in Jefferson County, Alabama. They were in a light, outboard boat in the Little Shoal Creek embayment of Bankhead Lake, an impoundment of the Black Warrior River.

At this point the arm of water is at least 100 yards wide, but without current. The two officers observed a Turkey (*Meleagris gallapavo*) poult at least 30 yards from the south bank and swimming north; another was seen only a few yards from the north bank where a mature wild Turkey hen accompanied by at least two other poults was calling frantically. The poults were traveling toward the mother bird, swimming strongly and floating fairly high in the water. Maneuvering the boat alongside the first poult, the officers picked it up, examined it, carried it to near the north bank and released it. The female turkey remained in the vicinity until joined by the two poults that had been in the water.

The poult picked up was covered with down except for the wing tips, which were beginning to develop feathers. Its age was estimated to be 10 days. A probable explanation of what occurred is that the hen had flown across the embayment and then called her poults, which followed by swimming. The poults were so young that the possibility that they had attempted flight across the water and fallen in is ruled out. Both officers are thoroughly familiar with wild Turkeys. One poult was examined in the hand and the hen and remaining poults were observed at close range, leaving no doubt as to the accuracy of the observation.—Leo M. Martin and Thomas Z. Atkeson, *Box 1643, Decatur, Alabama, June 1, 1954.*

Grackle kills English Sparrow.—I saw a Bronzed Grackle (*Quiscalus quiscula*) kill an adult female English Sparrow (*Passer domesticus*) about noon on June 2, 1954.

I heard sounds of conflict in my yard and saw four birds flying rapidly about in a small area: two Robins (*Turdus migratorius*), an English Sparrow, and a Bronzed Grackle. My eye followed the Robins as they veered off in separate directions, and then I became conscious of a struggle on the ground near the wall of the house next door. Here the grackle was holding the sparrow with its foot and driving its beak forcefully and rapidly against the sparrow's head. When I stepped forward, the grackle flew up into a nearby tree, where a pair of Robins had a nest. The grackle was attacked again by the Robins but persisted in the vicinity for several minutes. I was not able to determine if the nest had been molested.

The sparrow crouched on the ground breathing heavily. Both eyes were closed and fluid exuded from one of them. Fifteen minutes later its condition was unchanged. But when I returned six hours later, the sparrow was dead. It had not been moved nor damaged further. Dissection revealed that all of its wounds were on the head. Its forehead was severely crushed with fractures running down into both eye sockets and there was a puncture 3 mm. in diameter in the center of the occipital region. The eyeballs were intact.

As I was examining the dead sparrow, my daughter directed my attention to a headless bird fifty feet away, under the tree where I had first noticed the conflict earlier in the day. It proved to be an immature English sparrow, short-tailed but probably old enough to fly. It had been found early in the afternoon by children and appeared to have been killed the same day. It was badly lacerated in the shoulder area as though partly eaten, but was otherwise unmarked. I am not sure what killed and mutilated it but suspect that the grackle may have been engaged in this activity when attacked by the adult sparrow.– Harold Mayfield, *2557 Portsmouth Avenue, Toledo 13, Ohio, July 23, 1954.*

Great Horned Owl attacking squirrel nests.— The Great Horned Owl, *Bubo virginianus*, occasionally preys on the fox squirrel, *Sciurus niger* (see Errington, Hamerstrom, and Hamerstrom, 1940, *Research Bull. 277, Agr. Exp. Sta., Iowa State Coll.*, p. 791). However, the manner in which the owl catches this prey has not been recorded. Several observations have been made in Douglas County, Kansas, of the Great Horned Owl apparently seeking out squirrels in the daylight hours in an unusual manner.

At 10:30 a.m., on 19 November 1953, at the University of Kansas Natural History Reservation, while in the vicinity of Hole Woods (see Fitch, 1952. *Univ. Kansas Mus. Nat. Hist., Misc. Publ.* No. 4:10), I observed a Great Horned Owl slowly circling above the trees. Suddenly this bird glided swiftly downward at approximately a forty-five degree angle toward a yellow oak, *Quercus muehlenbergii*. When the owl was within about ten feet of the upper branches, it extended its feet and legs and then struck a squirrel leaf-nest in the periphery of the tree. A fox squirrel emerged, climbed down the supporting branch to the trunk of the tree and crouched there, facing the nest. The owl twice slowly circled the tree and alighted on the branch which bore the leaf-nest, facing the squirrel approximately eight feet away. When the owl lit on the limb, the squirrel began clicking its incisor teeth and continued this noise for about two minutes until the owl flew away south over Skiak Field (Fitch, *loc. cit.*). Thereupon, the squirrel descended to the ground and ran west, disappearing in understory vegetation. Immediately following the disappearance of the squirrel, I inspected the nest and thought it intact enough for further use by squirrels. Repeated observations and checks of the nest until March, 1954, however, revealed that it has deteriorated; it seemed not to have been used by squirrels after 19 November.

At 4:30 p.m., on 5 March 1954, three miles west and two miles south of Lawrence, Douglas County, Kansas, north of the Wakarusa River, I noticed a Great Horned Owl flying just above an American elm, *Ulmus americana*. The owl attacked a leaf-nest approximately forty feet above the ground in this tree, but no squirrel was flushed. The owl flew into woods to the west. Examination through binoculars showed the nest to be mutilated externally.

Cloud cover seemed not to govern the described behavior of the owls, for the sky was overcast on November 19 and cloudless on March 5.

Mr. Terry A. Vaughan, a fellow graduate student, told me that at 3:00 p.m. on 7 February 1954, two miles west of Lawrence, Douglas County, Kansas, he saw a Great Horned Owl carrying a dead fox squirrel. The owl flew out of a tree which seemingly was being used for a roost. Mr. Vaughan and I examined this area on 21 February 1954, and located five pellets, none of which contained any squirrel remains. In the immediate area, however, there were several leaf-nests damaged in a fashion similar to those described above.

In review: the Great Horned Owl catches fox squirrels in daylight, regardless of cloud cover, by searching out and striking leaf nests.—Robert L. Packard, *State Biological Survey, University of Kansas, Lawrence, Kansas, April 1, 1954.*

Pied-billed Grebe taking flight from land.—On April 26, 1954, a live, healthy Pied-billed Grebe (*Podilymbus podiceps*) was brought to my home in Mount Pleasant, Michigan. It had been found stranded on a wet highway which it presumably had mistaken for water. When placed on the lawn in my back yard, it sat quietly for several minutes while three people stood by it. Little or no wind was blowing. Suddenly the bird arose and beating its wings rapidly ran with pattering feet through the two-inch-high grass

and white clover (*Trifolium repens*) for about 20 feet and took flight. Gradually gaining altitude, it flew between two houses, turned down the street, and at an altitude of about 40 feet disappeared among some trees approximately 500 feet from the starting point. Bent (1919. *U.S. Natl. Mus. Bull.*, 107:44) states that the Pied-billed Grebe " . . . seems to be incapable of rising from the ground [to fly]." In the exceptional case I observed, the short grass and clover, like water, gave proper resistance to the rapidly moving feet for impetus to aid the wings in successfully taking flight.—NICHOLAS L. CUTHBERT, *Biology Department, Central Michigan College of Education, Mount Pleasant, Michigan, June 30, 1954.*

Hudsonian Curlew and Knot in Colorado.—During the spring migration of 1953 I made almost daily observation trips around Union Reservoir, a natural lake covering approximately 600 acres in Weld County, Colorado, three miles east of Longmont. On May 15 I saw six small curlews feeding along the south shore of the lake. Careful scrutiny revealed the characteristic markings of the Hudsonian Curlew (*Numenius phaeopus*), a species that, during more than twenty years of bird study, I had never before seen in either Colorado or Nebraska. One bird, a female, was collected and is in the skin collection of the Denver Museum of Natural History (No. 26738). Dr. A. M. Bailey, Director of the museum, confirmed my opinion as to the rarity of the species in Colorado, there being only one or two other records in the literature I have examined.

On May 18, 1953, a Knot (*Calidris canutus*) was collected at almost the same spot on the shore of Union Reservoir. Upon receipt of the specimen, a male, Dr. Bailey wrote, "So far as I can find, this is the first record of the Knot for Colorado." There is no record for Nebraska, but the species has been reported in Kansas. The skin (No. 26737) is now in the Denver Museum.—MRS. CARL N. COLLISTER, *Hover Road, Longmont, Colorado, April 14, 1954.*

Fish Crows "de-lousing" cattle.—Bent (1946. *U.S. Natl. Mus. Bull.* 191:279) in his account of the Fish Crow (*Corvus ossifragus*), citing N. B. Moore's notes, made many years ago, says that "these crows alight on the backs of cattle, to pick up the ticks that are burrowing into the skin and sucking the life blood from, as well as annoying, these animals; this may be an ancient habit, as it does not seem to have been recently observed."

Payne's Prairie, a 13,000 acre wet prairie south of Gainesville, Alachua County, Florida, supports many large herds of cattle. Fish Crows are common in this area. On the morning of 21 March 1954 we observed a Fish Crow perched on a cow's back; it was repeatedly pecking about the cow's pelvic region, near the base of the tail. Another crow, which was on the ground behind the cow, flew to the cow's back. After threats from both birds, the first bird left, and the second bird began pecking at the cow. It soon flew off, whereupon the first bird returned and continued pecking. The cow ignored the birds, except for once nuzzling its back, causing one of the crows to flutter up momentarily.

The crows were obviously picking ectoparasites from the cow; whether they were ticks, lice, or bots, we cannot say, since it was impracticable to examine the cow. A number of other species of birds, including the closely related Rook (*Corvus frugilegus*), have been observed "de-lousing" hoofed mammals (Rothschild and Clay, 1952. "Fleas, Flukes and Cuckoos").—DALE W. RICE AND EDWARD L. MOCKFORD, *Department of Biology, University of Florida, Gainesville, Florida, March 25, 1954.*

EDITORIAL

No editor's job is an unrelieved bed of roses and few authors feel that it should be. Nevertheless, there are some very real compensations for the occasional periods of quiet frenzy. One such compensation is the bliss with which I use the antithetical "quiet frenzy" without fear of an alien red pencil. A more important compensation is the intense satisfaction one gets from the generous cooperation of others. So there may be no doubt that this help is appreciated, I take the occasion of my last issue as editor of *The Wilson Bulletin* to acknowledge gratefully the willing assistance over the past three years of my associate editors and many members of the Wilson Ornithological Club. We turn the editorship over to Dr. Keith L. Dixon with best wishes and the earnest hope that members of the Wilson Club will give him the fine cooperation I have received.—H.B.T.

1955 ANNUAL MEETING

Official announcement of the meeting, which will be held at Stillwater, Oklahoma, over Easter weekend, April 7-10, and call for papers will be mailed to the membership early in the year. A brief outline of the plans of Dr. Fred Baumgartner's Local Committee on Arrangements, however, is given here to encourage early planning to attend. Stillwater is located in the interesting zone where eastern forest and western plains birds meet and where there is also considerable overlap of species found characteristically in the midwestern and southeastern sections of the country. The Oklahoma Ornithological Society will be hosts at an informal gathering at the Student Union on Friday evening, and the Annual Dinner will be held Saturday evening. Early morning field trips may be arranged to Lake Carl Blackwell, 10 miles west of Stillwater, and to the Prairie Chicken dancing grounds on the Osage ranches. The Sunday field trip to the Salt Plains National Wildlife Refuge will feature a typical western style barbecue lunch. A meeting in Oklahoma should be a memorable experience for our northern and eastern members and provides an opportunity for our western members to join actively in a Wilson Club annual meeting.

LOUIS AGASSIZ FUERTES RESEARCH GRANT

Application blanks for this annual award of $100 can be obtained from the Chairman of the Research Grant Committee, Dr. Kenneth C. Parkes, Carnegie Museum, Pittsburgh 13, Pennsylvania. Completed applications should be returned to Dr. Parkes by March 1, 1955. We urge all interested persons to apply for this grant, the purpose of which is to promote worthwhile ornithological research.

We present here a second annual supplement to the complete list of books in the Club Library published in 1952 (*Wilson Bulletin*, 64, No. 3:176–185). Members who lack the *Bulletins* in which the main list and the first supplement (1953) appeared may procure reprints of both by writing to the Wilson Ornithological Club Library, Museum of Zoology, Ann Arbor, Michigan. Other facts about the Library and the procedure for borrowing books may be found on the inner front cover of this *Bulletin*.

A number of important new books have been purchased from funds contributed by interested members. Other funds for this purpose were received from the sale of duplicate books and pamphlets at the Cape May meeting in June.

Gifts of books have again come from many members and friends, as recorded in the quarterly notices published in the *Bulletin*. Special mention should be made of the very generous gifts from Karl W. Haller, Rosario Mazzeo, Margaret Morse Nice, A. A. Saunders, and Harriet B. Woolfenden. Wendell Taber established an admirable precedent when he gave a number of volumes in memory of his old friend, Dr. Winsor M. Tyler, distinguished ornithologist and a member of the Club for forty years.

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THE CONTINUING NEED FOR FOOD HABITS RESEARCH

A contribution from the Wilson Ornithological Club Conservation Committee

Twenty years ago the writer called attention to certain limitations of stomach analysis in determining the economic status of birds (1934. *Wilson Bull.*, 46:73–90). The deficiencies mentioned pertained to (1) the difficulty in placing economic interpretations on some of the important food items disclosed, and (2) the impossibility of mathematically converting abstract food percentages into terms of human economics.

In the same article pains were taken to emphasize the everlasting importance of stomach analysis as a technique in disclosing information sorely needed in solving other problems in wildlife management. "Aside from the legitimate demands of pure research in food habits to which stomach examination has and will continue to contribute bountifully, certain of the practical problems of economic ornithology lend themselves to direct solution solely or largely through this method of approach, . . . those in which the identification of food items constitute the major objective. . . . Whenever we are seeking the *identity* of food items, irrespective of the economic significance of the bird's having fed on them, or whenever we aim to determine merely the presence or absence of particular items of diet, analysis of stomach contents is the only direct and reliable method of approach."

To illustrate my point I cited the case of the night herons, erroneously accused of being a hazard to the "frogging" industry of Louisiana. In the stomachs of more than a hundred, collected in the critical area, not one frog was discovered. Reference also was made to alleged damage to timber by birds when, as a matter of fact, actual injury was inflicted by insects more or less concealed, which served as a lure and in that manner incriminated the more conspicuous birds. Numerous other cases might have been cited at that time, and, since that article was written, even more convincing testimony could be invoked to demonstrate the importance of stomach analysis in solving certain aspects of modern wildlife- and farm-management problems.

How little this was appreciated even by those whose information should be reasonably accurate and how tragic ignorance may be under those circumstances, was revealed by

what took place in the legislative halls of our National Capitol about a decade ago. At that time an appropriation for the continuation of food habits studies of birds and mammals by the Fish and Wildlife Service was being discussed. A trite comment that "every small boy knows what a robin eats; it eats angleworms" was advanced as a reason for the termination of formal studies of the food of birds and mammals by the Fish and Wildlife Service. The project that had served as the basis of much of what we know in this field was thus ended.

Whereas it is true that, both at the Patuxent Wildlife Research Refuge in Maryland and at the Wildlife Research Laboratory at the Denver (Colorado) Federal Center, limited stomach analyses are still being conducted with finances and under authority provided from other sources, the activities are restricted largely to the solving of local or limited problems. The work often is carried out with finances and personnel coming from the Cooperative Wildlife Research Units or from Pittman-Robertson sources. At best it is an intermittent program with an uncertain future.

These facts are not generally known by those who long have looked to the Fish and Wildlife Service and its predecessor, the Biological Survey, as a source of factual information on the food and economics of wildlife. The lessened output of substantial contributions of such nature during recent years has been attributed by uninformed individuals to a variety of causes—to a change of interests by administrative personnel, to a feeling that there is nothing more of value to be done or learned, to a departure of those who, through the years, have contributed to the subject, or to some other surmise. Actually, the activity was terminated by a legislative and budgetary restriction from which there is no appeal or possibility of change except through those same channels. That there is an impelling need for well-equipped and competently staffed laboratories for wildlife food analyses is admitted by all who have attempted to do the same thing with inadequate means.

In the meantime reference collections and laboratory facilities and files, though maintained to the limits possible, have not been used to their fullest capacity and technical personnel, experienced in the field of stomach examination, has devoted its time largely to other matters. With such lapses associated values tend to deteriorate if not disappear from the scene. Without continued use, reference collections and their related files have suffered for lack of sympathetic attention; new and much needed additions have not been made; personnel involved has been handicapped through lack of "practice"; and, most important in a long-time appraisal of the situation, newcomers have not been trained to take the places of those, who for one reason or another, will step out of the picture.

Whereas the objectives of modern wildlife research are different from those of a generation ago, stomach examination as a means of investigation has lost none of its significance. It has even become of greater import through new applications. What wild creatures do or do not eat has a definite bearing on problems of nutrition and the contraction of disease. There is a growing conviction that the periodic mortality of Canada Geese at Pea Island, North Carolina may have its origin in a food habits or nutritional factor leading to excessive parasitism and ultimate emaciation and death of the birds.

Entomologists are still vitally concerned regarding the role of vertebrate enemies in the control of insect pests. Requests have been made in Colorado for an appraisal of woodpeckers in relation to the spruce bark beetles, and elsewhere with regard to the destructive spruce bud worm and the white pine weevil. In each case stomach examination of potential enemies would reveal from what source greatest aid might be expected. The extent to which birds avail themselves of proffered foods set out for their express use

is readily disclosed by the examined stomach. Consequently there is a continuing need of food habit studies to determine the usefulness of specific management practices on refuges, public shooting grounds and on other areas.

The knowledge of the experienced food analyst also has application in other directions. He may aid law enforcement in the identification of evidence, be it feathers, fur, bone, or even flesh or fats. Such testimony is seldom challenged and never effectively refuted. Knowledge now being used to assure correctness of labels in the fur industry had some of its beginnings in the laboratory where the stomachs of coyotes and bobcats and the regurgitated food pellets of birds of prey were being examined.

That the end products of wildlife food analysis may go far beyond the province of the wildlife technician is brought out by the Martin, Zim, Nelson volume on "American Wildlife and Plants" (McGraw-Hill Book Company, Inc., New York, 1951). Therein the condensed information gleaned from the thousands of stomachs of birds and mammals, fish, reptiles and amphibians examined during a period of over 60 years, is made available for foresters, landscape-gardeners, and botanists. Even the morphology of seeds and the phylogeny of the plants which bear them have been given a significant stimulus through studies based on the food habits collections at the Patuxent Laboratory of the Fish and Wildlife Service (Martin, A. C., 1946. *American Midl. Naturalist*, 36:513–660).

From the very nature of the case food habits research laboratories have to be adequate. Their reference collections must be well supplied with bird and mammal skins and skeletons, alcoholic specimens of reptiles, amphibians, fishes, crustacea, and various fleshy invertebrates, pinned specimens of insects, microscopic slides of hair and fur samples, an herbarium of wildlife food plants, a comprehensive collection of seeds and other fruits of plants likely to be eaten and, above all else an adequate reference library to aid in the identification of specimens. There must also be working facilities, microscopes, collection cases, fume hoods to remove objectionable odors, and the ordinary tools, reagents and other materials that permit it to function effectively.

Then, of course, there is the all-important element of a competent staff with which to operate. In the field of stomach analysis of wildlife there is no substitute for experience. Without that even the most complete of collections and the best of technical equipment will avail little.

The foregoing all points to the fact that, if research in wildlife is to avail itself of food analysis as a working tool, the facilities needed are destined to be extensive and costly; to create these on short notice would be impossible and to duplicate them locally throughout the country would be highly uneconomical.

A score of years ago one of America's leading ecologists sounded a warning against the perennial impoverishment of research in food habits of birds and mammals (Errington, 1935. *Science*, 81, (2103):378–379). "It seems more than a little ironical that this division [of the Biological Survey] with its highly trained personnel, its unmatched reference collections and its strategic possibilities as an ecological clearing house be the perennial target of crippling economies, with occasionally its very existence threatened.

"In short, from the standpoint of one interested in wildlife management and foreseeing the great development that will surely occur, it is apparent that the necessary supporting researches into the food habits of organisms are barely entering the tremendous field of significant endeavor that awaits."

If such apprehension was justified at a time when modest funds were still available for the study of the food of wildlife by a Federal agency, what form of expression can adequately portray the present situation?—E. R. Kalmbach.

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Anderson, T(homas) J(ohn), 3 Niven, Box 856, New Liskeard, Ontario, Canada 1953
Anderson, William Deans, 3100 Beverly Road, Austin 3, Texas 1950
Andrews, Mrs. J. Clinton, Three Stone Alley, Nantucket, Massachusetts 1946
Andrews, James Clinton, Three Stone Alley, Nantucket, Massachusetts 1947
Anthes, Clarence A(lvin), 707 No. Moreland Blvd., Waukesha, Wisconsin 1939
Anthony, Jesse D., 722 1st Ave., East, Grand Rapids, Minnesota 1944
*Appel, Thomas G., 63 Sunnyside Ave., Pleasantville 2, New York 1950
*Arbib, Robert S(imeon), Jr., 231 W. Lena Ave., Freeport, New York 1947
Armington, Sven, Blanchegatan 18, Stockholm, Sweden 1948
*Armstrong, Miss Virginia, Old Concord Road, South Lincoln, Massachusetts 1939
Arnett, Dr. John Hancock, Jr., 6200 Ardleigh St., Philadelphia 38, Pennsylvania 1944
Arnold, Elting, 4914 Dorset Ave., Chevy Chase 15, Maryland 1941
Arny, Samuel A., 6515 Willston Drive, Apt. 2, Falls Church, Virginia 1947
Aronoff, Dr. Arthur Edward, University Hospital, Ann Arbor, Michigan 1948
*Ashton, Randolph, 800 Crown St., Morrisville, Pennsylvania 1941
Atkeson, Thomas Zephaniah, P. O. Box 1643, Decatur, Alabama 1953
Austin, Mrs. Harold C. (Enid K.), 1116 Mandana Road, Oakland 10, California 1950
Austin, John Brander, 2510 Nashville Ave., New Orleans, Louisiana 1947
Austin, Dr. Oliver L(uther), 28 Fairview Ave., Tuckahoe, New York 1930
*Avery, John A(rthur), 3411 So. Westnedge, Kalamazoo, Michigan 1952
Axtell, Harold H., Buffalo Museum of Science, Humboldt Park, Buffalo 11, New York 1950
Axtell, Richard C(harles), 465 State St., Albany, New York 1954

Bacon, Brasher Collins, Sr., Spring Lake Wildlife Sanctuary, Chickadee Hill, Madisonville, Kentucky 1948
Baer, Miss Myrtle W., 1237 No. Jefferson St., Milwaukee 2, Wisconsin 1941
**Bagg, Aaron Moore, 72 Fairfield Ave., Holyoke, Massachusetts 1948
Baier, Mrs. John (Carol), 111 "C" St., Martinez, California 1949
Bailey, Alfred Marshall, Denver Museum of Natural History, City Park, Denver 6, Colorado 1928
*Bailey, Harold H(arris), Rockbridge Alum Springs Biological Laboratory, R.D. #2, Goshen, Virginia 1908
Bailey, Mrs. H. M., 1020 Jones St., Apt. 4, Sioux City 18, Iowa 1918
*Baily, A(lbert) Lang, Davenport Public Museum, 704 Brady St., Davenport, Iowa 1953
Baird, James, 83 Payson Lane, University Heights, New Brunswick, New Jersey 1954
**Baker, B(ernard) W(illiam), R.D.#1, Judson Road, Spring Lake, Michigan 1938
Baker, John H(opkinson), 1165 Fifth Ave., New York, New York 1930
Baker, Maurice F(rank), Southwestern College, Winfield, Kansas 1947
*Baker, Paul S(eaman), 19 Heckscher Drive, Huntington, L.I., New York 1946
Baker, Rollin Harold, Museum of Natural History, Univ. of Kansas, Lawrence, Kansas 1938
Baker, William C(alvin), 559 Euclid St., Salem, Ohio 1931
Baldwin, Mrs. Amy G., 6335 Kimbark Ave., Apt. B., Chicago 37, Illinois 1943
Ball, Miss Henrietta S(ophia), 1213 So. Third St., Lafayette, Indiana 1951
Ball, Kathleen E., 8704 112th St., Edmonton, Alberta, Canada 1946
*Balsom, Mrs. Amos Parker, 2209 E. Stratford Court, Milwaukee 11 Wisconsin 1949
*Bamman, Miss Barbara Cleghorn, 16 Rollingmead, Princeton, New Jersey 1954
Banks, Clinton S(eeger), 202 Wilma Ave., Steubenville, Ohio 1945
Banta, Miss Edna, Mary Gray Bird Sanctuary, R.D. #6, Connersville, Indiana 1945
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Barber, Miss Lucy, Box 6092, Station A., Charleston 2, West Virginia 1950
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Barbour, Llewellyn P(helps), 4780 Wood St., Willoughby, Ohio 1948
Bard, Fred George, Curator, Provincial Museum, Normal School, Regina, Saskatchewan, Canada 1946
Barnes, Charles K(napp), 5006 So. Michigan Road, South Bend, Indiana 1949
Barnes, William Bryan, 311 W. Washington St., Indianapolis 9, Indiana 1941
Barrett, Lewis LeRoy, 2737 Ulysses St., N. E., Minneapolis 18, Minnesota 1949
Bartel, Karl E(mil) Edgar, 2528 W. Collins St., Blue Island, Illinois 1934
Bartleson, Fred D(urant), Jr., Dept. of Biology, University of Florida, Gainesville, Florida 1952
Bartlett, Guy, 1053 Parkwood Blvd., Schenectady 8, New York 1938
Bartlett, Wesley H., 122 So. Ridgley, Algona, Iowa 1936
Bartsch, Paul, "Lebanon", Gunston Hall Rd., Lorton, Virginia 1894
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Batchelder, Charles Foster, 7 Kirkland St., Cambridge, Massachusetts 1927
Batchelder, Edgar M(arden), 56 Orchard St., Marblehead, Massachusetts 1941
**Batts, H(enry) Lewis, Jr., 1211 Glenwood Ave., Kalamazoo, Michigan 1946
Baumel, Julian J., Dept of Anatomy, Creighton School of Medicine, Creighton Univ., Omaha, Nebraska 1951
Baumgartner, Milton D(aniel), 1822 W. Sunset Drive, Stillwater, Oklahoma 1944
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Baylor, L(eslie) M(ilton), 1912 Tyler Road, Boulder, Colorado 1954
Beals, Everett K(err), 1310 No. 11th St., Manhattan, Kansas 1953
Beardslee, Clark Smith, 132 McKinley Ave., Kenmore 17, New York 1942
Beardsley, Miss M(argaret) Hortense, 330 No. Chestnut St., Ravenna, Ohio 1941
Beebe, William, 33 W. 67th St., New York, New York 1944
Beecher, William J(ohn), Chicago Natural History Museum, Chicago 5, Illinois 1948
Behle, William H(arroun), Dept. of Biology, Univ. of Utah, Salt Lake City, Utah 1935
Behrens, Harry Carl, Box 1055, Rapid City, South Dakota 1950
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Belfore, Stanley Alexander, 3452 Harrisburg St., Pittsburgh 4, Pennsylvania 1953

Bell, Henry, III, 246 W. Evergreen Ave., Chestnut Hill, Philadelphia 18, Pennsylvania 1946
Bell, Mrs. William F., 210 Carden Ave., Nashville 5, Tennessee 1954
Bellrose, Frank, Jr., Illinois Natural History Survey, Havana, Illinois 1935
Bemont, Leslie E(dward), R.D. #3, Binghamton, New York 1954
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Bennett, Miss Esther (Vorena), 406 W. Oak St., Carbondale, Illinois 1954
Bennett, Holly Reed, 2457 Orchard St., Chicago 14, Illinois 1949
Bennett, Miss Mary A(llison), 623 E. Carroll St., Macomb, Illinois 1933
Benson, Seth Bertram, 645 Coventry Rd., Berkeley 7, California 1930
Bent, Arthur C(leveland), 140 High St., Taunton, Massachusetts 1893
Benton, Allen H(aydon), New York State College for Teachers, Dept. of Biology, Albany, New York 1953
**Berger, Andrew J(ohn), Dept. of Anatomy, University of Michigan, Ann Arbor, Michigan 1940
Berger, Daniel D(avid), 510 E. MacArthur Road, Milwaukee 17, Wisconsin 1953
**Bergstrom, E(dward) Alexander, 37 Old Brook Road, West Hartford 7, Connecticut 1943
*Berkey, Glenn L., 22 So. State St., Rittman, Ohio 1951
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Biaggi, Virgilio, Jr., College of Agriculture, Mayaguez, Puerto Rico 1945
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Binford, L(aurie) C(harles), Museum of Zoology, Bird Division, Univ. of Michigan, Ann Arbor, Michigan 1954
Birch, Robert Lee, Dept of Biology, West Virginia Univ., Morgantown, West Virginia 1950
Bird, Dick, 2721 Assiniboine Ave., Regina, Saskatchewan, Canada 1949
Birkeland, Henry, Roland, Iowa 1934
Black, Charles T(heodore), R.D. #1, Box 480, East Lansing, Michigan 1935
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Blake, Charles H(enry), Woodland Way, Lincoln, Massachusetts 1950
Blake, Emmet R(eid), Chicago Natural History Museum, Chicago 5, Illinois 1939
Blake, Mrs. Grace R. (Mrs. Henry Seavey) 1933 Westwood Drive, Topeka, Kansas 1950
Blanchard, Miss Dorothy, 2014 Geddes Ave., Ann Arbor, Michigan 1952
Blanchard, Harold H(ooper), 32 Calumet Rd., Winchester, Massachusetts 1946
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Blazer, Warren G., P.O. Box 107, Los Angeles 28, California 1949
**Bleitz, Donald Lewis, 1001 No. McCadden Place, Los Angeles 38, California 1948
Bliese, John C(arl) W(illiam), Biology Dept., Nebraska State Teachers College, Kearney, Nebraska 1951
Blinco, Ben(edict) Joseph, 8766 No. Main St., Dayton 5, Ohio 1919
Bloor, Edwin David, Jr., 3 Grandview Ave., Lawrenceville, New Jersey 1954
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Blowey, William, Mafeking, Manitoba, Canada 1951
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Bodmer, Mrs. Herbert A. (Olive A.), Box 14, Kenmare, North Dakota 1950
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Boldt, Wilbur, Box 293, Jamestown, North Dakota 1949
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Bonar, John S(tanley), West Liberty, West Virgina 1954
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Bond, Richard M(arshall), King's Hill, St. Croix, U.S. Virgin Islands 1936
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Borror, Donald J(oyce), Dept. of Zoology & Entomology, Ohio State Univ., Columbus, 10, Ohio 1927

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Bowdish, Beecher S(coville), Demarest, New Jersey 1921
Bowen, Robert Marvin, 5009 Leeds Ave., Baltimore 27, Maryland 1947
Bower, Winifred F. (Mrs. F. L.), R.D. #1, Lee's Hill Road, Basking Ridge New Jersey 1954
Bowers, J. Basil, 975 Juanita, Campbell, California 1942
Boyd, Miss Elizabeth M(argaret), Mount Holyoke College, South Hadley, Massachusetts 1941
Boyd, Hugh J., Severn Wildfowl Trust, Slimbridge, Gloucestershire, England 1946
Boyd, Ivan L., Dept. of Biology, Baker Univ., Baldwin, Kansas 1951
Boyer, George Frederick, R.D. #1, West Sackville, New Brunswick, Canada 1949
Boyer, Miss G(ertrude) Paula, 420 E. Second Ave., Roselle, New Jersey 1953
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Bradburn, Donald Muir, 461 Pine St., New Orleans 18, Louisiana 1950
Braden, Miss Paula Lou, 3857 Kings Highway, Brooklyn 34, New York 1953
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Branch, Mrs. Margaret G(amble), 1324 Wells St., Ann Arbor, Michigan 1952
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Braunschweig, Mrs. Lee W(elsh), 5758 No. Fifth St., Philadelphia 20, Pennsylvania 1953
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Brecht, Miss Grace Elizabeth, 1328 Clinton Ave., Irvington 11, New Jersey 1949
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Breiding, George H(erbert), Naturalist, Oglebay Institute, Wheeling, West Virginia 1942
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Broadbooks, Harold E(ugene), 14333 Corliss Ave., Seattle 33, Washington 1948
Brockschlager, Miss Mary Elizabeth, 518 E. Fourth St., Cincinnati 2, Ohio 1948
Brodkorb, Pierce, Dept. of Biology, Univ. of Florida, Gainesville, Florida 1951
*Brody, Dr. Gerald L(ee), University Hospital, Ann Arbor, Michigan 1954
*Broley, Charles L(avelle), Delta, Ontario, Canada 1946
Brooks, Mrs. Chester K., P.O. Box 168, Bennington, Vermont 1952
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Broun, Maurice, R.D. #2, Kempton, Pennsylvania 1935
Brown, Clarence D., 222 Valley Road, Montclair, New Jersey 1938
Brown, Miss Doranne, 8 Charlton St., Princeton, New Jersey 1954
Brown, E(lmer) E(vans), Davidson College, Davidson, North Carolina 1945
Brown, Jerram L., 19 Hitchcock Road, Amherst, Massachusetts 1950
Brown, N(orman) Rae, Faculty of Forestry, Univ. of New Brunswick, Fredericton, New Brunswick, Canada 1945
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Browning, Miss Helen G., 206 W. Oak St., Louisville 3, Kentucky 1952
Bruce, James A(ddison), 565 E. Spring St., Wooster, Ohio 1952
*Brueggemann, Miss Anna L(ouise), 584 Sheridan Ave., Columbus 9, Ohio 1943
**Bruns, James Henry, 1820 Jefferson Ave., New Orleans, Louisiana 1941
Bryan, Dr. Burton Donald, 162 French St., Fall River, Massachusetts 1949
*Bryens, Oscar McKinley, 231 So. Main St., Three Rivers, St. Joseph County, Michigan 1924
Buchanan, Forest Wendell, Amsterdam, Ohio 1939

Buchheister, Carl W., 1130 Fifth Ave., New York 28, New York 1943
Buckland, George (Henry) (Edward), R.D. #1, Batavia, New York 1949
Bucknell, Donald N(eedham), 134 Wonham, Ingersoll, Ontario, Canada 1953
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Bull, John L., Jr., 49 Merrall Rd., Far Rockaway, New York 1952
Bunnell, John R., 1920 Baltimore Ave., Cincinnati 25, Ohio 1953
Bunting, Mrs. Elizabeth, Washington Rd., Penn's Neck, Princeton, New Jersey 1954
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Bures, Joseph August, 148 No. 3rd St., West Newton, Pennsylvania 1946
Burford, Mrs. Floy C(ooper), 108 Lake Terrace, Norfolk 2, Virginia 1952
Burland, Lee J(ohnson), Snook Apartments, Castleton-on-Hudson, New York 1939
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Burner, Miss Florence H(elen), 5350 Reisterstown Road, Baltimore 15, Maryland 1948
Burnett, Frances L., Proctor St., Manchester, Massachusetts 1950
Burnham, Miss Gladys L(ou), 1409 N.E. 19th St., Oklahoma City, Oklahoma 1954
Burns, Robert David, Univ. of California, c/o Dept. of Zoology, Los Angeles 24, California 1948
Burr, Irving W(ingate), 265 Littleton St., West Lafayette, Indiana 1945
Burr, Miss Margaret, 943 Summit Ave., St. Paul 5, Minnesota 1952
Burt, William Henry, Museum of Zoology, Univ. of Michigan, Ann Arbor, Michigan 1928
Burton, Donald E(rnest), 171 Strathearn Road, Toronto 10, Ontario, Canada 1953
Burtt, Harold E., 2163 No. Starr Ave., Columbus 12, Ohio 1953
Bushman, John, Univ. of Utah, Ecological Research, Dugway, Utah 1951
Butchart, Mrs. G. Reeves, Museum of Zoology, Univ. of Michigan, Ann Arbor, Michigan 1943
Butsch, Robert Stearns, University Museum, Univ. of Michigan, Ann Arbor, Michigan 1947
Byers, (Mrs.) Esther, 1110½ So. University, Ann Arbor, Michigan 1951
Bytzko, Miss Anne, 13563 Arlington, Detroit 12, Michigan 1948

Cade, Tom, 526 Gayley, Los Angeles 24, California 1950
Cagle, Fred R., Dept. of Zoology, Univ. of Tulane, New Orleans 15, Louisiana 1942
Cahalane, Victor H(arrison), National Park Service, Washington 25, D.C. 1933
*Calef, Robert, 734 E. University, Ann Arbor, Michigan 1954
Calhoun, John B(umpass), National Institute of Mental Health, Bldg. 10, Bethesda 14, Maryland 1949
Calvert, Earl Wellington, R.D. #2, County Home, Lindsay, Ontario, Canada 1937
Calvert, William J(onathan), Jr., 615 No. Pelham Road, Jacksonville, Alabama 1942
Calvin, Robert L(eal), R.D. #3, Fairhill Drive, New Castle, Pennsylvania 1951
Campbell, John David, 1222 W. State St., Geneva, Illinois 1944
Campbell, Louis W(alter), 4531 Walker Ave., Toledo 12, Ohio 1926
Campbell, Miss Mildred F(lorence), 29 No. Hawthorne Lane, Indianapolis 19, Indiana 1938
Canfield, Mrs. Donald T(rent), 903 Fifth St., West Lafayette, Indiana 1952
Carl, Harry G., 2304 Davie St., Davenport, Iowa 1949
Carmony, (Donald) Duane, 223 So. Bryan, Bloomington, Indiana 1953
**Carnes, Mrs. Herbert E., (Lucille H.), 25 Kenwood Road, Tenafly, New Jersey 1944
Carpenter, Charles C., Dept. of Zoology, University of Oklahoma, Norman, Oklahoma 1951
Carpenter, Floyd S., 2402 Longest Ave., Louisville 4, Kentucky 1934
Carroll, Col. Robert P., 213 Maiden Lane, Lexington, Virginia 1942
**Carrothers, Miss Vera, 14704 Alder Ave., East Cleveland 12, Ohio 1938
Carson, L(enwood) B(allard), 1306 Lincoln St., Topeka, Kansas 1948
Carson, (Miss) Rachel L., 204 Williamsburg Drive, Silver Spring, Maryland 1951
*Carter, Mrs. Mitchell, Jr., (Mrs. Annette H.), Ravine Road, Trenton 8, New Jersey 1954
Carter, Dennis (Lee), 715 Ohio St., Webster City, Iowa 1947
*Carter, Mrs. E. W. (Bertha May), R.D. #2, Perrysburg, Ohio 1946

Cartwright, Bertram William, c/o Ducks Unlimited (Canada), 201 Bank of Commerce Bldg., Winnipeg, Manitoba, Canada 1930
Cassel, J(oseph) Frank(lin), Dept. of Zoology, North Dakota Agricultural College, Fargo, North Dakota 1940
Castenholz, Richard William, Botany Dept., Washington State University, Pullman, Washington 1949
Cater, Milam B(rison), P.O. Box 15, Clifton Forge, Virginia 1944
**Chalif, Edward Louis, 37 Barnsdale Road, Short Hills, New Jersey 1947
Challey, John (Raymond), 1349 2nd St., No., Fargo, North Dakota 1948
Chambers, Miss Amy C., 2905 Irving, So., Minneapolis 8, Minnesota 1950
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Chance, Edgar P(ercival), Ambarrow Wood, Sandhurst, Berkshire, England 1941
Chandik, Theodore Alexander, 1236 119th St., Whiting, Indiana 1954
Chapelle, Major Francis O(berlin), U.S. Army Hospital, Ft. Clayton, Canal Zone 1954
Chapin, James P(aul), c/o IRSAC, Boite Postale 217, Bukavu, Kivu, Belgian Congo 1945
*Chapin, John L(adner), Univ. of Colorado Medical School, Physiology Dept., Denver 7, Colorado 1947
Chapman, Miss Blanche Hammond, 1325 So. 19th St., Birmingham, Alabama 1953
Chapman, Floyd B(arton), 392 Walhalla Road, Columbus 2, Ohio 1932
*Chapman, Herman Floraine, 712 South Dakota Ave., Sioux Falls, South Dakota 1947
Chapman, Lawrence B., R.D., Hubbardston, Massachusetts 1940
Chapman, Mrs. Lois Nichols, 712 So. Dakota Ave., Sioux Falls, South Dakota 1953
Chapman, Mrs. Naomi Fran, 1138 Leavitt Ave., Flossmoor, Illinois 1945
Chase, Henry B., Jr., 517 Decatur St., New Orleans 16, Louisiana 1932
Chell, Thomas Ross, 219 Arthur Ave., Peoria, Illinois 1952
Childs, Henry E(verett), Jr., Compton College, Compton, California 1948
Choate, Ernest A., 411 Rodman Ave., Jenkintown, Pennsylvania 1954
Chutter, Miss Mildred C., Box 229, Athens, Ohio 1936
Clark, Mrs. Ben P., 948 Forrest Ave., Gadsden, Alabama 1952
**Clarkson, Mrs. Edwin O., Wing Haven, 248 Ridgewood Ave., Charlotte 7, North Carolina 1940
Clausen, Arthur W(illiam), 120 W. Main St., Dwight, Illinois 1947
Clay, William M(arion), Dept. of Biology, University of Louisville, Louisville 8, Kentucky 1947
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*Clem, Robert Verity, 129 Gillies Road, Hamden, Connecticut 1951
Clement, Roland C(harles), 26 Brookfield Road, Riverside 15, Rhode Island 1941
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Clow, Miss Marion, Box 163, Lake Forest, Illinois 1929
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Cobb, Boughton, 25 East End Ave., New York, New York 1949
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Coffey, Lula C(ooper), (Mrs. Ben B., Jr.), 672 No. Belvedere, Memphis 7, Tennessee 1952
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Cogswell, Howard L(yman), Dept. of Biological Sciences, Mills College, Oakland 13, California 1944
Cole, (Mrs.) Elizabeth L(ahrman) (Mrs. A. Dean, Jr.), 5535 Renner Road, R.D. #1, Shawnee, Kansas 1953
**Cole, Richard D., 615 Lake Drive, Towson 4, Maryland 1949
Collias, Nicholas E(lias), 710 W. Beecher Ave., Jacksonville, Illinois 1945
Collins, Henry H., Jr., 136 Parkview Ave., Bronxville 8, New York 1952
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Comfort, James F., 27 No. Iola Drive, Webster Groves 19, Missouri 1947
Compton, Lawrence Verlyn, Biology Division, Soil Conservation Service, Washington 25, D.C. 1923
**Conboy, Mrs. John William (Mrs. Esther Cogswell), 417 Studebaker St., Mishawaka, Indiana 1954

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Conkey, John H., 11 Chestnut St., Ware, Massachusetts 1947
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Conrad, Charles L(ouis), 1206 Warwood Ave., Wheeling, West Virginia 1937
Conway, Albert E., R.D. #4, Easton, Pennsylvania 1939
Conway, June R. (Mrs. Albert E.), R.D. #4, Easton, Pennsylvania 1954
Cook, Bill J(ames), 21 Grove Ave., Glendale, Ohio 1948
Cook, Miss Fannye A(dine), 1119 Pinehurst, Jackson, Mississippi 1923
Coolidge, Herman W(illiam), R.D. #6, Isle of Hope, Savannah, Georgia 1952
Coombes, Robert Armitage Hamilton, The Zoological Museum, Tring, Hertfordshire, England 1936
Cope, James B(onwill), Earlham College, Richmond, Indiana 1949
Cors, Paul B(eaumont), 722 Woodside Ave., Ripon, Wisconsin 1952
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Cottrel, George William, Jr., 70 Lake View Ave., Cambridge 38, Massachusetts 1941
Cottrille, Mrs. W. Powell (Betty Darling), 6075 Brown's Lake, Jackson, Michigan 1950
Cottrille, Dr. W(illiam) Powell, 6075 Brown's Lake, Jackson, Michigan 1949
Cox, George W., 111 Griswold St., Delaware, Ohio 1954
Coy, Roy E., St. Joseph Museum, St. Joseph, Missouri 1953
Craighead, John J., 435 South Ave., Missoula, Montana 1950
*Crawford, Alan, Jr., White Horse Road, Devon, Pennsylvania 1949
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Crichton, Vincent, Chapleau, Ontario, Canada 1948
Crone, Miss Mary C., 1680 Sixth St., Apt. 6, Boulder, Colorado 1949
Crowder, Orville W(right), Chase, Maryland 1946
Crowell, John B., Jr., 49 Irving St., Apt. 5, Cambridge, Massachusetts 1952
Cruickshank, Allan Dudley, Box 256, Rockledge, Florida 1939
Cumming, Fairman Preston, 824 Sutton Hill Road, Nashville 4, Tennessee 1950
Cummings, G(eorge) Clark, #61 Broadway, New York 6, New York 1952
Cunningham, James W., 3009 E. 19th Terrace, Kansas City, Missouri 1935
Cunningham, Miss Nance C., 702 Marshall, Houston 6, Texas 1950
Cunningham, Richard L(ynn), 216 Oliver Lee Drive, Belleville, Illinois 1953
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Darby, Richard T(horn), 5236 Cedar Ave., Philadelphia 43, Pennsylvania 1948
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Daubendiek, Miss Bertha A., 38228 Harper Ave., Mt. Clemens, Michigan 1953
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Davey, Dr. Winthrop N(ewbury), University Hospital, Ann Arbor, Michigan 1941
Davidson, Miss Sarah A., 344 Summit Ave., St. Paul 2, Minnesota 1949
Davidson, Mrs. W. F. (Caroline F.), 332 Summit Ave., St. Paul 2, Minnesota 1953
Davidson, William Mark, 1504 Bodell St., Orlando, Florida 1933
Davis, Clifford Vernon, Dept. of Zoology & Entomology, Montana State College, Bozeman, Montana 1945
Davis, David E(dward), School of Hygiene & Public Health, Johns Hopkins University, Baltimore 5, Maryland 1940
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Davis, Howard Henry, Esq., Little Stoke, Patchway, Bristol, England 1947
Davis, John, Hastings Natural History Reservation, Carmel Valley, California 1939
Davis, L(ouie) Irby, Box 988, Harlingen, Texas 1933
Davis, Lt. Paul A(nthony), 829 Grant St., Gary, Indiana 1953
Davis, Russell S., Clayton, Illinois 1947
Davis, Wayne Harry, Museum of Natural History, University of Illinois, Urbana, Illinois 1953
Davis, W(illiam) B., Dept. of Wildlife Management, College Station, Texas 1938
Davis, William Franklin, 423 W. 46th St., Ashtabula, Ohio 1947
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Dawn, Walter H(enry), 53-55 64th, Ridgewood Plateau, Maspeth 78, L.I., New York 1945
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DeGarmo, William Russell, Kents Hill, Maine 1946
DeGroot, Dudley Sargent, Athletic Branch, S.A.D., U.S.A.R.E.U.R., A.P.O. 245, c/o Postmaster, New York, New York 1948
Dehner, Reverend Eugene W(illiam), St. Benedict's College, Atchison, Kansas 1944
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Howell, Joseph C., Dept. of Zoology & Entomology, University of Tennessee, Knoxville 16, Tennessee 1938
Howell, Thomas R(aymond), Dept. of Zoology, University of California, Los Angeles 24, California 1947
Hoyt, Mrs. Sally F. (Mrs. Southgate Y.), "Aviana," Box 54, Etna, New York 1952
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Huenecke, Howard S(everin), Des Lacs National Wildlife Refuge, Kenmare, North Dakota 1952
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Hughes, Gilbert C., III, P.O. Box 668, Homerville, Georgia 1952
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Humphrey, Philip Strong, Museum of Zoology, University of Michigan, Ann Arbor, Michigan 1948
Hundley, Marion Lee, 305 Second St., N.W., Carrollton, Ohio 1950
Hunnewell, Miss Louisa, 848 Washington St., Wellesley, Massachusetts 1951
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Huntington, Charles Ellsworth, Dept. of Biology, Bowdoin College, Brunswick, Maine 1950
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Jahn, Laurence Roy, 129 Juneau St., Horicon, Wisconsin 1950
James, Douglas Arthur, P.O. Box 3566, Arsenal, Arkansas 1946
James, Pauline, Biology Dept., Pan American College, Edinburg, Texas 1952
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Jaques, Florence Page, East Oaks Road, North Oaks Farms, St. Paul 13, Minnesota 1950
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Jenkins, James H(obart), School of Forestry, Univ. of Georgia, Athens, Georgia 1939
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Johnson, Robert A(nthony), R.D. #2, Gosport, Indiana 1930
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Kenaga, Eugene E., 1629 Isabella Road, R.D. #5, Midland, Michigan 1949
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Kenyon, Karl W(alton), U.S. Fish & Wildlife Service, 8923 236th St., S.W., Edmonds, Washington 1948
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Leavitt, Benjamin Burton, Dept. of Biology, University of Florida, Gainesville, Florida 1947
Leedy, Daniel L(oney), U.S. Fish & Wildlife Service, Branch of Wildlife Research, Washington 25, D.C. 1936
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Leonard, Dr. James P(atrick), 1605 Arlington Ave., Davenport, Iowa 1951
Leopold, Frederic, 111 Clay St., Burlington, Iowa 1950
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Lester, Joseph Evans, R.D. #1, Aliquippa, Pennsylvania 1952
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Levy, Alice K(lund), (Mrs. H. P.), 840 Seward St., Hollywood 38, California 1941
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Lewis, Harrison F(lint), West Middle Sable, Shelburne County, Nova Scotia, Canada 1939
Lewis, William O(wen), Box 22, Ivy, Virginia 1953
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Lowther, Malcolm Alfred, 22599 Kane Ave., Detroit 23, Michigan 1944

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McDonald, Norman J., 2016 Locust St., Philadelphia 3, Pennsylvania 1954
McEntee, Mrs. Howard G. (Elinor G.), 490 Fairfield Ave., Ridgewood, New Jersey 1948
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McKinley, Daniel L(awson), Stephens Hall, University of Missouri, Columbia, Missouri 1948
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**Melone, Miss Theodora G(ardner), Geology Library, Pillsbury Hall, Univ. of Minnesota, Minneapolis 14, Minnesota 1947
Meltvedt, Burton W., Paullina, Iowa 1930
**Meng, Heinz Karl, 116 Miller St., Ithaca, New York 1943
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*Mengel, Robert M(orrow), Museum of Natural History, Univ. of Kansas, Lawrence, Kansas 1937
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Moreno, Abelardo, Museo Poey, Catedra "U", Escuela de Ciencias, Univ. of Havana, Havana, Cuba 1949
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Murphy, Paul C(harles), 935 Goodrich Ave., Apt. 10, St. Paul 5, Minnesota 1944
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Myers, Buford M(acMartin), Jr., 45 Oakland St., New Orleans 23, Louisiana 1948
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Nelson, Gid E(dmund), Jr., Alabama College, Montevallo, Alabama 1953
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Nero, Robert William, Dept. of Zoology, Univ. of Wisconsin, Madison 5, Wisc. 1947
*Ness, Robert David, 17 Five Points Road, Rush, New York 1951
Nessle, James P., R.D. #1, Waterville, Ohio 1936
*Netting, M(orris) Graham, Carnegie Museum, Pittsburgh, 13, Pennsylvania 1941
Nevius, Mrs. Richard, R.D. #1, Greeneville, Tennessee 1940
New, John G., Conservation Dept., Fernow Hall, Cornell Univ., Ithaca, New York 1946
*Newberry, A(ndrew) Todd, 70 Rock Spring Road, West Orange, New Jersey 1952
Newman, Robert J(ames), Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana 1950
Nice, Dr. L(eonard) B., 5725 Harper Ave., Chicago 37, Illinois 1932
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*Nichols, John Treadwell, American Museum of Natural History, 79th St., & Central Park W., New York 24, New York 1941
*Nicholson, Donald John, 1224 Palmer St., Orlando, Florida 1945
Nickell, Walter Prine, Cranbrook Institute of Science, Bloomfield Hills, Mich. 1943
Nields, James F(ulton), Jr., Hardwick, Massachusetts 1949
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Nighswonger, Paul F., R.D. #9, Alva, Oklahoma 1950
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Norman, James L(ee), c/o Bebb Floral Co., Muskogee, Oklahoma 1948
Norris, Robert Allen, Dept. of Zoology, Rutgers Univ., New Brunswick, New Jersey 1941
Norse, William J(ohn), 531 W. 211th St., New York 34, New York 1939
North, George W(ebster), 249 Charlton Ave., W., Hamilton, Ontario, Canada 1941
Northrop, Mrs. Harson A., 358 E. Main St., Owatonna, Minnesota 1952
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O'Callaghan, Terence C., Maromala R.D., Bay of Islands, Northland, New Zealand 1954
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Odum, Howard Thomas, Biology Dept., Univ. of Florida, Gainesville, Florida 1946
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Olson, Mrs. Monrad J., Watford City, North Dakota 1946
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Packard, Fred Mallory, 24 Elizabeth Lane, R.D. #2, Fairfax, Virginia 1949
Packard, Robert Lewis, 704 Maine St., Lawrence, Kansas 1954
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Palmer, Ralph S(imon), New York State Museum, State Education Bldg., Albany 1, New York 1934
Palmer, T(heodore) S(herman), 1939 Biltmore St., N.W., Washington, D.C. 1914
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Pangborn, Mark W(hite), 25 E. 56th St., Indianapolis, Indiana 1948
*Parkes, Kenneth Carroll, Carnegie Museum, Pittsburgh 13, Pennsylvania 1946
Parks, Richard Anthony, 2303 Pembrook Place, N.E., Atlanta, Georgia 1942
Parmelee, David F(reeland), 533 Harding, Iron Moutain, Michigan 1949
Partridge, William H., Belgrano 363, Caseros F.C.S.M., Buenos Aires, Argentina, South America 1953
Patton, Bradley M., 2126 Highland Road, Ann Arbor, Michigan 1953
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Paynter, R(aymond) A(ndrew), Jr., Museum of Comparative Zoology, Harvard University, Cambridge 38, Massachusetts 1946
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Perkins, Mrs. Mary Loomis, 1305 So. 52nd St., Omaha 6, Nebraska 1946
Peter, Julius C(hristian), 307 Ridgemont, Grosse Pointe Farms 36, Michigan 1953
Peterle, Tony J., Dept. of Natural History, Morischal College, Univ. of Aberdeen, Aberdeen, Scotland 1951

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Peters, Stuart S., c/o Paul Griffin, R.D. #2, Freeville, New York 1952
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Petersen, Paula R. (Mrs. Pete C.), 620 E. 30th St., Davenport, Iowa 1952
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Petrides, George A., Division of Conservation, Michigan State College, East Lansing, Michigan 1942
Petroskey, Miss Helen Martha, Box 7, Hiram, Ohio 1949
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Pettit, Lincoln C(oles), Box 217, Hiram, Ohio 1948
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Potter, Julian K(ent), 437 Park Ave., Collingswood 7, New Jersey 1915
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Quay, Thomas L., Zoology Dept., North Carolina State College, Raleigh, North Carolina 1939
Quay, W(ilbur) B(rooks), Museum of Zoology, Univ. of Michigan, Ann Arbor, Michigan 1949
Quilliam, Mrs. H(elen) R(ose), 86 Brock St., Kingston, Ontario, Canada 1953
Quimby, Don C., Dept. of Zoology & Entomology, Montana State College, Bozeman, Montana 1942

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Rand, Austin L., Chicago Natural History Museum, Roosevelt Road & Lake Shore Drive, Chicago 5, Illinois 1950
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Randall, Robert Neal, 928 16th St., Bismarck, North Dakota 1939
Randle, Worth S., Box 63, Cincinnati 20, Ohio 1949
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Reese, C(arl) R(ichard), 266 E. Dunedin Road, Columbus 14, Ohio 1948
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Rett, Egmont Z(achary), Museum of Natural History, Santa Barbara, Calif. 1940
Reuss, Alfred Henry, 2908 Edison St., Blue Island, Illinois 1936
Reynard, George B., 728 Parry Ave., Palmyra, New Jersey 1950
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Rice, Dale (Warren), Biology Dept., Univ. of Florida, Gainesville, Florida 1946
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Roberts, Harold D., 610 Harrison St., Black River Falls, Wisconsin 1946
Robins, C(harles) Richard, Dept. of Conservation, Fernow Hall, Cornell Univ. Ithaca, New York 1949
Robinson, Thane S., Museum of Natural History, Univ. of Kansas, Lawrence, Kansas 1952
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Rogers, K(ay) T(rowbridge), Dept. of Zoology, Oberlin College, Oberlin, Ohio 1952
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Rogers, Mrs. Walter E., 911 E. North St., Appleton, Wisconsin 1931
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Rosewall, O(scar) W(aldemar), Dept. of Zoology, Louisiana State Univ., Baton Rouge 3, Louisiana 1931
Rositzky, Simon, 1605 Ashland Blvd., St. Joseph, Missouri 1953
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Scott, Thomas G(eorge), Section of Game Research and Management, Illinois Natural History Survey, Urbana, Illinois 1936
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Searles, Scott, Dept. of Chemistry, Kansas State College, Manhattan, Kansas 1951
Seeber, Edward L(incoln), 213 Columbia St., Ithaca, New York 1944
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Sibley, Fred C(harles), R.D. #1, Alpine, New York 1953
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Sieh, James G(erald), Biology Bldg., Okoboji, Iowa 1948
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Singleton, Albert Roland, 3968 Marburg Ave., Cincinnati 9, Ohio 1948
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Skutch, Alexander F(rank), San Isidro del General, Costa Rica, Central America 1944
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Smith, Miss Marion L(ucille), 429 So. Willard St., Burlington, Vermont 1949
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Southern, William, Clare, Michigan 1954
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Struthers, Dana R., 4858 Fremont Ave., So., Minneapolis 9, Minnesota 1948
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BY JANE S. MENGEL

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The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Club loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

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OF THE

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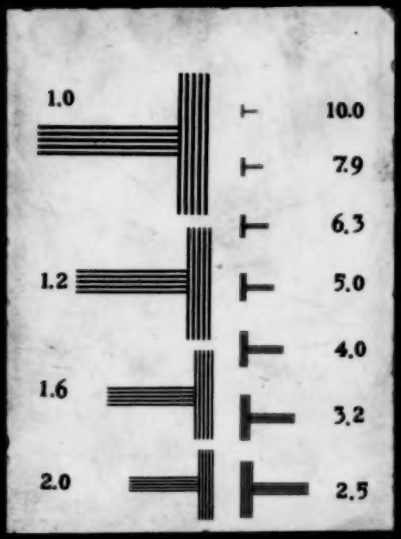

100 MILLIMETERS

INSTRUCTIONS Resolution is expressed in terms of the lines per millimeter recorded by a particular film under specified conditions. Numerals in chart indicate the number of lines per millimeter in adjacent "T-shaped" groupings.

In microfilming, it is necessary to determine the reduction ratio and multiply the number of lines in the chart by this value to find the number of lines recorded by the film. As an aid in determining the reduction ratio, the line above is 100 millimeters in length. Measuring this line in the film image and dividing the length into 100 gives the reduction ratio. Example: the line is 20 mm. long in the film image, and $100/20 = 5$.

Examine "T-shaped" line groupings in the film with microscope, and note the number adjacent to finest lines recorded sharply and distinctly. Multiply this number by the reduction factor to obtain resolving power in lines per millimeter. Example: 7.9 group of lines is clearly recorded while lines in the 10.0 group are not distinctly separated. Reduction ratio is 5, and $7.9 \times 5 = 39.5$ lines per millimeter recorded satisfactorily. $10.0 \times 5 = 50$ lines per millimeter which are not recorded satisfactorily. Under the particular conditions, maximum resolution is between 39.5 and 50 lines per millimeter.

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